APPENDIX C

ENVIRONMENTAL SAMPLING FREQUENCY AND PARAMETERS

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INTRODUCTION

This appendix provides a summary of the environmental sampling frequencies and parameters for the effluent monitoring and environmental surveillance activities at the Paducah Site.

C1. GROUNDWATER MONITORING

The Paducah Site samples individual monitoring and residential wells on a routine basis. Additionally, monitoring wells (MWs) are monitored for water levels on a routine basis. The Groundwater Program Manager is responsible for accepting any new MWs installed and assuring that the wells meet the following:

1. Construction requirements as outlined in either the Statement of Work, Field Sampling Plan, or Work Plan for the project.

2. Acceptance criteria for well development as outlined in the Bechtel Jacobs Company procedures.

3. Requirements for pump and packer placement.

4. The well is properly functioning and has no deficiencies.

MWs that do not meet these requirements will not be accepted by the Groundwater Program Manager until all deficiencies have been corrected.

New MWs added during calendar year (CY) 2003 which do not have specific regulatory sampling requirements and are not included in this Plan will be monitored according to the Semiannual Environmental Surveillance Program. When the CY 2004 Environmental Monitoring Plan is issued, these new MWs will be incorporated into the appropriate program and documented.

Well Inspection. All MWs located within the plant perimeter fence are inspected at a minimum on an annual basis. Wells located outside the plant perimeter fence and off-site are inspected on an annual basis. Well inspections are conducted as required by CDM-012, *Groundwater Monitoring Sampling.*

C-746-S, C-746-T, and C-746-U Landfills (Solid Waste Landfill Monitoring)

Frequency: Quarterly

Driver: Sampling requirements are outlined in the landfill permits issued by KDWM.

Rationale: To evaluate the potential impact of waste disposal activities at the C-746-S, C-746-T, C-746-U Landfills on groundwater quality and to comply with compliance monitoring requirements.

Rule: If there is a statistical increase over background or exceedences of an Maximum Contaminant Limit (MCL) using the statistical methods outlined in the permits, then confirm the exceedence by evaluating available site groundwater monitoring data to determine if another Solid Waste Management Unit (SWMU) is impacting landfills. If another SWMU is impacting the landfills, then attempt a source demonstration by collecting additional samples. Otherwise, establish an assessment monitoring program utilizing the groundwater protection standard (Alternate Contaminant Level (ACL), MCL, or background).

Comments: The dissolved metal samples are only to be analyzed if the total metal component exceeds the MCL. In the event a metal doesn't have an MCL, the detection limit will be used to determine if the dissolved component will be analyzed.

New wells were installed in 2002 for these landfills. The baseline sampling events were conducted from April through September 2002.

Table C.1 C-746-S and C-746-T Landfill wells.
MW220
MW221
MW222
MW223
MW224
MW369*
MW370*
MW372*
MW373*
MW384
MW385
MW386
MW387
MW388
MW389
MW390
MW391
MW392
MW393
MW394
MW395
MW396
MW397

Table C.2 C-746-U Landfill wells.
MW357
MW358
MW359
MW360
MW361
MW362
MW363
MW364
MW365
MW366
MW367
MW368
MW369
MW370
MW371
MW372
MW373
MW374
MW375
MW376
MW377

* Wells are sampled with C-746-U Landfill

Table C.3 C-746-S, C-746-T, C-746-U quarterly analytical parameters.

Volatiles	Anions
1,1,1,2-Tetrachloroethane	Bromide
1,1,1-Trichloroethane	Chloride
1,1,2,2-Tetrachloroethane	Fluoride
1,1,2-Trichloroethane	Nitrate as Nitrogen
1,1-Dichloroethane	Sulfate
1,1-Dichloroethene	
1,2,3-Trichloropropane	**Field Parameters**
1,2-Dibromo-3-chloropropane	Barometric Pressure
1,2-Dibromoethane	Specific Conductance
1,2-Dichlorobenzene	Depth to water
1,2-Dichloroethane	Dissolved Oxygen
1,2-Dichloropropane	Eh
1,4-Dichlorobenzene	pH
2-Butanone	Temperature
2-Chloroethyl Vinyl Ether	Turbidity
2-Hexanone	
4-Methyl-2-pentanone	**Metals**
Acetone	Aluminum
Acrolein	Antimony
Acrylonitrile	Arsenic
Benzene	Barium
Bromochloromethane	Beryllium
Bromodichloromethane	Boron
Bromoform	Cadmium
Bromomethane	Calcium
Carbon Disulfide	Chromium
Carbon Tetrachloride	Cobalt
Chlorobenzene	Copper
Chloroethane	Iodide
Chloroform	Iron
Chloromethane	Lead
cis-1,2-Dichloroethene	Magnesium
cis-1,3-Dichloropropene	Manganese
Dibromochloromethane	Mercury
Dibromomethane	Molybdenum
Dichlorodifluoromethane	Nickel
Dimethylbenzene, Total*	Potassium
Ethanol	Rhodium
Ethyl Methacrylate	Selenium
Ethylbenzene	Silver
Iodomethane	Sodium
Methylene Chloride	Tantalum
Styrene	Thallium
Tetrachloroethene	Uranium
Toluene	Vanadium
trans-1,2-Dichloroethene	Zinc
trans-1,3-Dichloropropene	Barium, Dissolved
trans-1,4-Dichloro-2-Butene	Chromium, Dissolved
Trichloroethene	Uranium, Dissolved
Trichlorofluoromethane	
Vinyl Acetate	
Vinyl Chloride	**Radionuclides**
	Alpha Activity
Miscellaneous	Beta activity
Total Dissolved Solids	Iodine-131
COD	Radium-226
Cyanide	Strontium-90
Total Organic Carbon	Technetium-99
TOX	Thorium-234
	Tritium

* Xylenes

Table C.4 C-746-S, C-746-T, C-746-U annual analytical parameters.

PCBs
PCB, Total
PCB-1016
PCB-1221
PCB-1232
PCB-1242
PCB-1248
PCB-1254
PCB-1260
PCB-1268

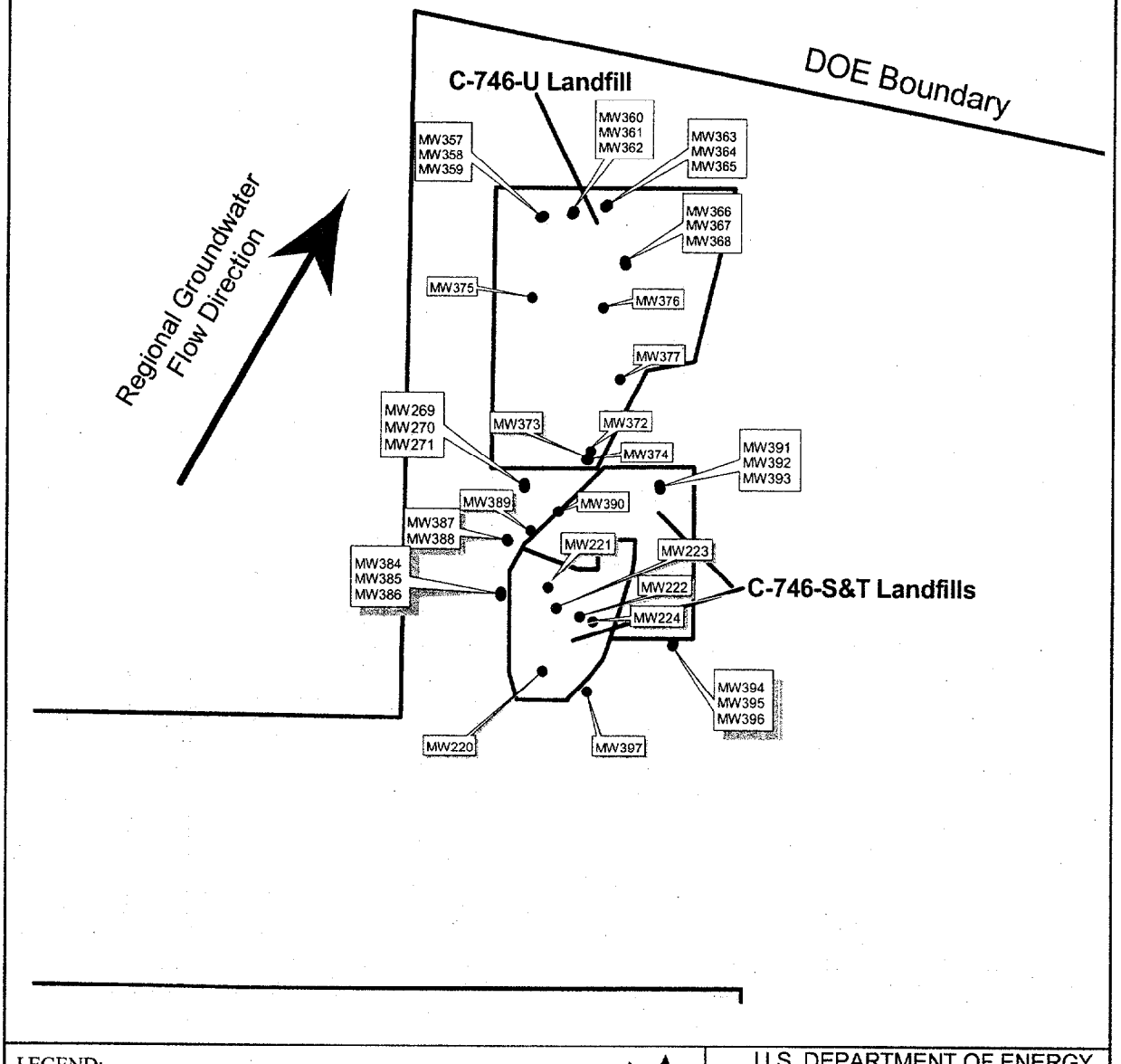

Figure C-1 Groundwater monitoring wells near the C-746-S, T, and U Landfills.

C-404 Low-level Radioactive Waste Burial Ground (RCRA Detection Status Monitoring)

Frequency: Semiannually

Driver: The semiannual parameters are required to be sampled per the Environmental Protection Agency (EPA) Hazardous Waste Permit Number KY 8-890-008-982..

Rationale: To monitor the C-404 Low-level Radioactive Waste Burial Ground under detection monitoring status regulations.

Decision Rule: If there is a statistical increase using the Analysis of Variance (ANOVA) method, over background, using the permit parameters as the indicator parameters, then confirm the exceedence by evaluating available site groundwater monitoring data to determine if another SWMU is impacting C-404. If another SWMU is impacting C-404, then attempt a source demonstration by collecting additional samples. Otherwise establish a compliance monitoring program utilizing a groundwater protection standard such as an ACL, MCL, or background. If the groundwater protection standard is exceeded under compliance monitoring, then establish a corrective action program.

Comments: In the event a partial sample can only be obtained the following priority will be followed: field parameters, TCE, metals. The dissolved metal samples (arsenic, cadmium, chromium, lead, mercury, and selenium) are filtered in the laboratory. The dissolved metals are only anlayzed if the metal is detected in the un-filtered sample.

MW90 and MW95 were replaced in 2002 with MW90A and MW95A, respectively..

Table C.5 C-404 Landfill wells.

MW226
MW227
MW84
MW85
MW86
MW87
MW88
MW89
MW90A
MW91
MW92
MW93
MW94
MW95A

Table C.6 C-404 Landfill semiannual analytical parameters.

Volatiles	Metals
Trichloroethene	Chromium, Dissolved
	Arsenic, Dissolved
Field Parameters	Cadmium, Dissolved
Barometric Pressure	Lead, Dissolved
Specific Conductance	Mercury, Dissolved
Depth to water	Chromium
Dissolved Oxygen	Arsenic
Eh	Cadmium
pH	Lead
Temperature	Mercury
Turbidity	Selenium
	Selenium, Dissolved
Radionuclides	Uranium
Technetium-99	Uranium, Dissolved

C-746-K Landfill Monitoring

Driver: Requirements to sample four monitoring wells are outlined in the Record of Decision (ROD) for WAGs 1 and 7. In addition, the parameters to be analyzed were originally documented in the Sampling and Analysis Plan Addendum, KY/ER-2. The ROD allows for annual evaluation of parameters. This document was superceded by this Environmental Monitoring Plan.

Rationale: To evaluate the potential impact of waste disposal activities at the C-746-K Landfill on ground-water quality.

Comments: In the event a well becomes dry while purging, no sample will be taken. However, it should be recorded that no sample was collected because the well was dry. In a letter dated May 23, 1996, the Commonwealth of Kentucky denied a request by DOE to reduce the sampling frequency from quarterly to semiannually. The interim corrective measures work plan specified the addition of metals analysis to the sampling plan. Dissolved metals are only analyzed if there are detections in the unfiltered sample.

Table C.7 C-746-K Landfill wells.

MW300
MW301
MW302
MW344

Table C.8 C-746-K Landfill quarterly analytical parameters.

Volatiles	Metals
1,1,1-Trichloroethane	Barium, Dissolved
1,1,2-Trichloroethane	Beryllium, Dissolved
1,1-Dichloroethane	Cadmium, Dissolved
1,1-Dichloroethene	Lead, Dissolved
1,2-Dichloroethane	Arsenic, Dissolved
Benzene	Uranium, Dissolved
Bromodichloromethane	Aluminum
Carbon Tetrachloride	Arsenic
Chloroform	Barium
cis-1,2-Dichloroethene	Beryllium
Dimethylbenzene, Total	Cadmium
Ethylbenzene	Calcium
Tetrachloroethene	Iron
Toluene	Lead
trans-1,2-Dichloroethene	Magnesium
Trichloroethene	Manganese
Vinyl Chloride	Nickel
	Potassium
Radionuclides	Sodium
Alpha Activity	Uranium
Beta Activity	
Technetium-99	**Field Parameters**
	Specific Conductance
Anions	Depth to water
Chloride	Dissolved Oxygen
Sulfate	Eh
Nitrate	pH
	Temperature
	Turbidity
	Alkalinity
	Ferrous Iron

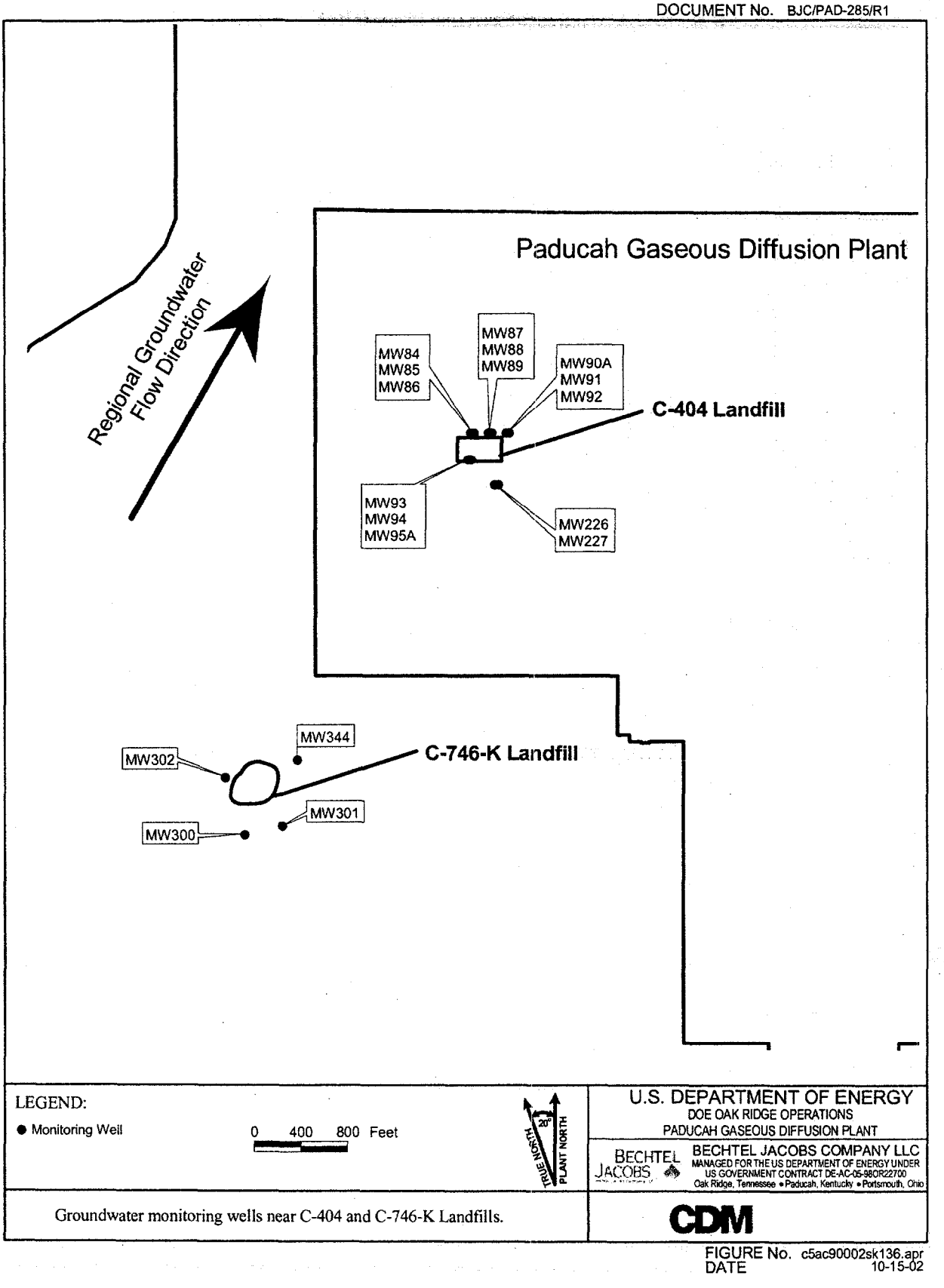

Figure C-2 Groundwater monitoring wells near C-404 and C-746-K Landfills.

NORTHEAST PLUME OPERATIONS AND MAINTENANCE PROGRAM

Northeast Plume Monitoring

Frequency: Quarterly - One quarter a year the annual list of parameters is also sampled.

Driver: The MWs are required to be sampled according to the *Operations and Maintenance Plan for the Northeast Plume* (DOE 1999).

Rationale: To monitor the nature and extent of groundwater contamination and to evaluate any cyclic trends in water quality that may affect contaminant migration.

Comments: The dissolved metal samples are only to be analyzed if the total metal component exceeds the detection limit.

The extraction wells are not sampled under the groundwater program but rather are sampled under the *Operations and Maintenance Plan for the Northeast Plume* (DOE 1999).

Table C.9 Northeast Plume wells.
MW124
MW126
MW145
MW255
MW256
MW258
MW283
MW284
MW288
MW291
MW292
MW293
MW294

Table C.10 Northeast Plume quarterly analytical parameters.

Volatiles	Radionuclides
1,1,1-Trichloroethane	Alpha Activity
1,1,2-Trichloroethane	Beta Activity
1,1-Dichloroethane	Technetium-99
1,1-Dichloroethene	
1,2-Dichloroethane	**Field Parameters**
Benzene	Barometric Pressure
Bromodichloromethane	Specific Conductance
Carbon Tetrachloride	Depth to water
Chloroform	Dissolved Oxygen
cis-1,2-Dichloroethene	Eh
Dimethylbenzene, Total	pH
Ethylbenzene	Temperature
Tetrachloroethene	Turbidity
Toluene	
trans-1,2-Dichloroethene	
Trichloroethene	
Vinyl Chloride	

Table C.11 Northeast Plume annual analytical parameters.

Dissolved Metals	Metals
Aluminum, Dissolved	Aluminum
Antimony, Dissolved	Antimony
Barium, Dissolved	Barium
Beryllium, Dissolved	Beryllium
Cadmium, Dissolved	Cadmium
Calcium, Dissolved	Calcium
Chromium, Dissolved	Chromium
Cobalt, Dissolved	Cobalt
Copper, Dissolved	Copper
Iron, Dissolved	Iron
Lead, Dissolved	Lead
Magnesium, Dissolved	Magnesium
Manganese, Dissolved	Manganese
Molybdenum, Dissolved	Molybdenum
Nickel, Dissolved	Nickel
Potassium, Dissolved	Potassium
Silver, Dissolved	Silver
Sodium, Dissolved	Sodium
Zinc, Dissolved	Zinc
Arsenic, Dissolved	Arsenic
Mercury, Dissolved	Mercury
Selenium, Dissolved	Selenium
Uranium, Dissolved	Uranium
Anions	**Miscellaneous**
Fluoride	Total Dissolved Solids
Chloride	Alkalinity
Nitrate as Nitrogen	Silica
Sulfate	Phosphate as Phosphorus
	Total Organic Carbon

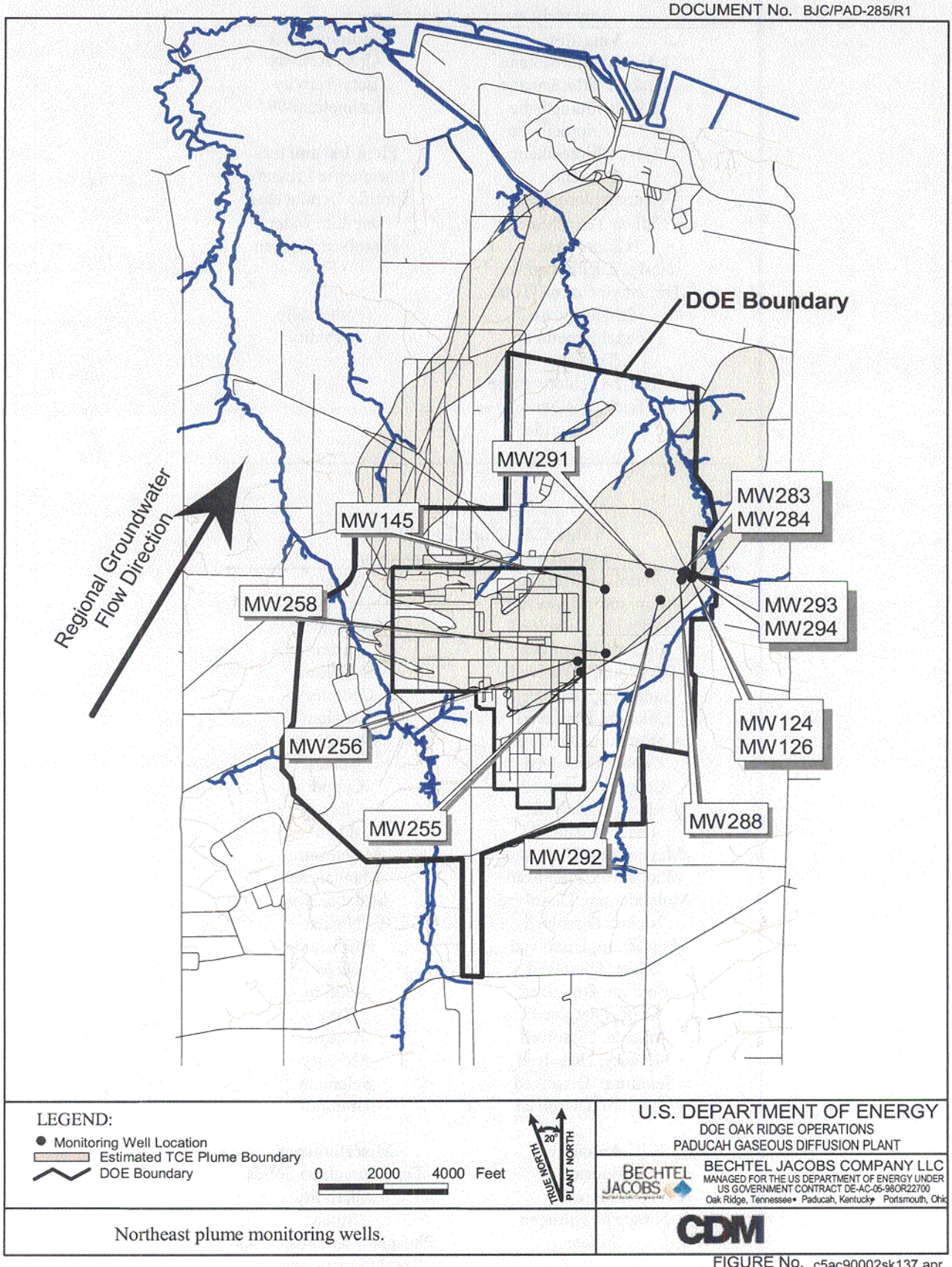

Figure C-3 Northeast Plume monitoring wells.

NORTHWEST PLUME OPERATIONS AND MAINTENANCE PROGRAM

Northwest Plume Monitoring

Frequency: Quarterly - One quarter a year the annual list of parameters is also sampled.

Driver: The MWs are required to be sampled according to the *Operations and Maintenance Plan for the Northwest Plume (DOE 1999).*

Rationale: To monitor the nature and extent of groundwater contamination and to evaluate any cyclic trends in water quality that may affect contaminant migration.

Comments: The dissolved metal samples are only to be analyzed if the total metal component exceeds the detection limit.

The extraction wells are not sampled under the groundwater program but rather are sampled under the *Operations and Maintenance Plan for the Northwest Plume (DOE 1999).*

MW235 and 235 were replaced by MW380 and MW81, respectively.

Table C.12 Northwest Plume wells.

North Wells
MW233
MW236
MW237
MW238
MW239
MW240
MW241
MW380
MW381
South Wells
MW242
MW243
MW244
MW245
MW246
MW247
MW248
MW249
MW250

Table C.13 Northwest Plume quarterly analytical parameters.

Volatiles	Field Parameters
1,1,1-Trichloroethane	Barometric Pressure
1,1,2-Trichloroethane	Specific Conductance
1,1-Dichloroethane	Depth to water
1,1-Dichloroethene	Dissolved Oxygen
1,2-Dichloroethane	Eh
Benzene	pH
Bromodichloromethane	Temperature
Carbon Tetrachloride	Turbidity
Chloroform	
cis-1,2-Dichloroethene	**Metals**
Dimethylbenzene, Total	Phosphate as Phosphorus
Ethylbenzene	Aluminum, Dissolved
Tetrachloroethene	Calcium, Dissolved
Toluene	Iron, Dissolved
trans-1,2-Dichloroethene	Magnesium, Dissolved
Trichloroethene	Manganese, Dissolved
Vinyl Chloride	Potassium, Dissolved
	Sodium, Dissolved
Radionuclides	Aluminum
Alpha Activity	Calcium
Beta Activity	Iron
Technetium-99	Magnesium
	Manganese
Other	Potassium
Silica	Sodium

Table C.14 Northwest Plume-North wells annual analytical parameters.

Dissolved Metals	Metals
Antimony, Dissolved	Antimony
Barium, Dissolved	Barium
Beryllium, Dissolved	Beryllium
Cadmium, Dissolved	Cadmium
Chromium, Dissolved	Chromium
Cobalt, Dissolved	Cobalt
Copper, Dissolved	Copper
Lead, Dissolved	Lead
Molybdenum, Dissolved	Molybdenum
Nickel, Dissolved	Nickel
Silver, Dissolved	Silver
Zinc, Dissolved	Zinc
Arsenic, Dissolved	Arsenic
Mercury, Dissolved	Mercury
Selenium, Dissolved	Selenium
Miscellaneous	**Anions**
Total Dissolved Solids	Fluoride
Alkalinity	Chloride
Total Organic Carbon	Nitrate as Nitrogen
	Sulfate

Table C.15 Northwest Plume-South wells annual analytical parameters.

Dissolved Metals	Metals
Antimony, Dissolved	Antimony
Barium, Dissolved	Barium
Beryllium, Dissolved	Beryllium
Cadmium, Dissolved	Cadmium
Chromium, Dissolved	Chromium
Cobalt, Dissolved	Cobalt
Copper, Dissolved	Copper
Lead, Dissolved	Lead
Molybdenum, Dissolved	Molybdenum
Nickel, Dissolved	Nickel
Silver, Dissolved	Silver
Zinc, Dissolved	Zinc
Arsenic, Dissolved	Arsenic
Mercury, Dissolved	Mercury
Selenium, Dissolved	Selenium
Uranium, Dissolved	Uranium
Radionuclides	**Anions**
Radon-222	Fluoride
Neptunium-237	Chloride
Radium-226	Nitrate as Nitrogen
Plutonium-239	Sulfate
Thorium-230	
	Miscellaneous
	Total Dissolved Solids
	Alkalinity
	Total Organic Carbon

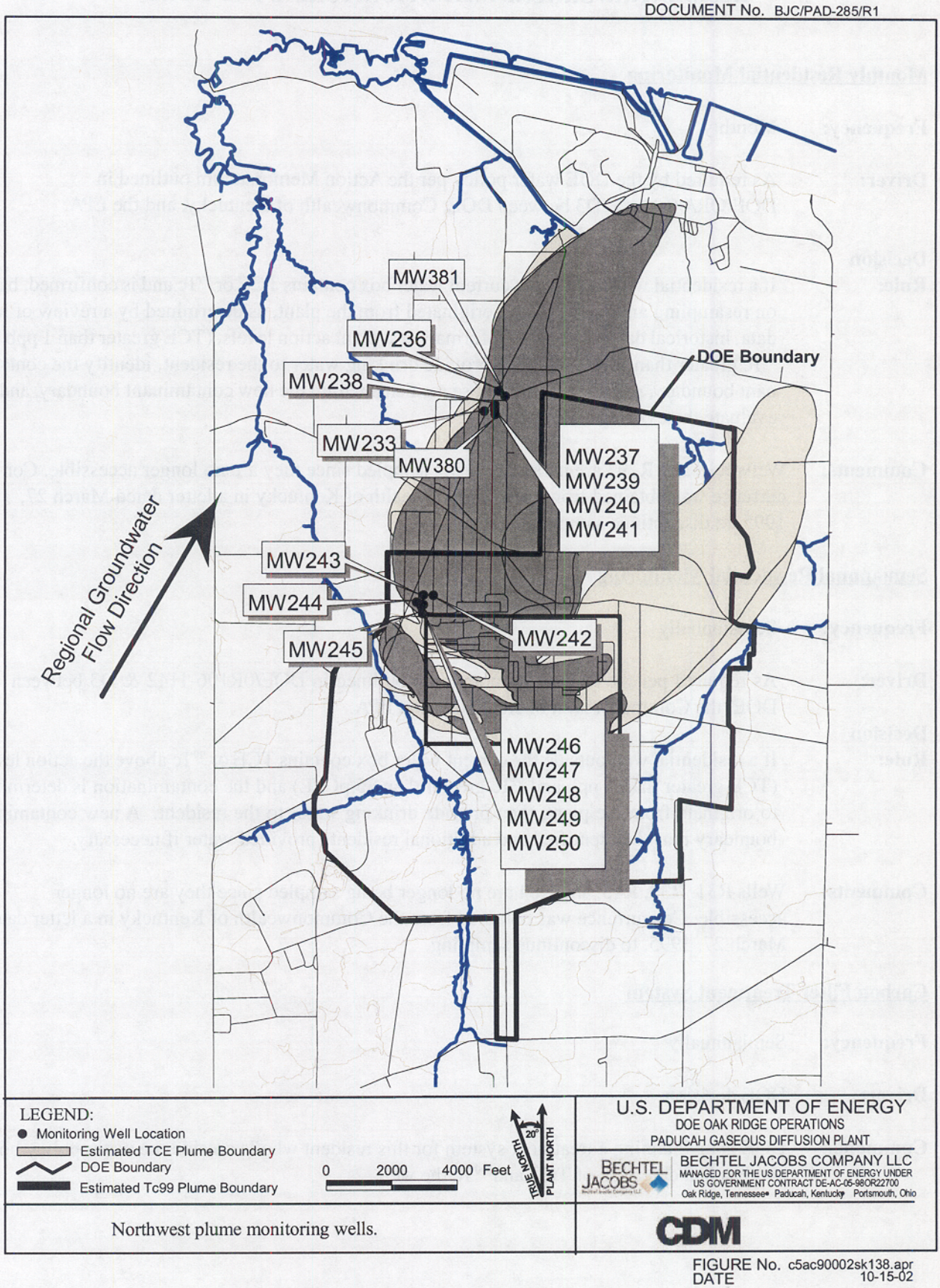

Figure C-4 Northwest Plume monitoring wells.

RESIDENTIAL GROUNDWATER MONITORING PROGRAM

Monthly Residential Monitoring

Frequency: Monthly

Driver: As required by the DOE water policy per the Action Memorandum outlined in DOE/OR/06-1142&D3 between DOE, Commonwealth of Kentucky, and the EPA.

Decision Rule: If a residential well outside the current water box contains TCE or ^{99}Tc and is confirmed, based on resampling and analysis, and originated from the plant, as determined by a review of MW data, historical data, or existing information at plant action levels, (TCE greater than 1 ppb and ^{99}Tc greater than 25 pCi/L), then provide drinking water to the resident, identify the contaminant boundary, provide water to those residents within the new contaminant boundary, and re-evaluate the existing water policy.

Comments: Wells R18 and R293 are no longer being sampled since they are no longer accessible. Concurrence was obtained from the Commonwealth of Kentucky in a letter dated March 27, 1995, to discontinue sampling.

Semiannual Residential Monitoring

Frequency: Semiannually

Driver: As required per the Action Memorandum outlined in DOE/0R106-1142 & D3 between DOE, the Commonwealth of Kentucky, and EPA.

Decision Rule: If a residential well outside the current water box contains TCE or ^{99}Tc above the action levels (TCE greater than 1 ppb and ^{99}Tc greater than 25 pCi/L) and the contamination is determined to originate from the plant, then provide drinking water to the resident. A new contaminant boundary must be identified and additional residents provided water if necessary.

Comments: Wells R31, R39, R43, and R84 are no longer being sampled since they are no longer accessible. Concurrence was obtained from the Commonwealth of Kentucky in a letter dated March 27, 1995, to discontinue sampling.

Carbon Filter Treatment System

Frequency: Semiannually

Driver: DOE decision

Comments: DOE is maintaining a treatment system for this resident who is outside the water policy box and has had detection of TCE and ^{99}Tc the well.

Table C.16 Residential wells.
Monthly
R2
R294
R302
Semiannual
R114
R12
R13
R14
R19
R20
R21
R23
R381
R383
R384
R387
R392
R72
R82
R83
R9
R90
Carbon Filter
R424

Table C.17 Residential analytical parameters.
Monthly
Specific Conductance
Depth to water
Dissolved Oxygen
pH
Temperature
Alpha Activity
Beta Activity
Technetium-99
Trichloroethene
Semiannual
Conductivity
Depth to water
Dissolved Oxygen
pH
Temperature
Technetium-99
Trichloroethene
Carbon Filter
Technetium-99
Total Coliform
Trichloroethene

FFA/ COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT (CERCLA) REQUIRED MONITORING

MW66 Environmental Surveillance Monitoring

Frequency: Monthly

Driver: MW66 is required to be sampled monthly per the Paducah FFA between DOE, EPA, and the Commonwealth of Kentucky.

Rationale: To monitor the nature and extent of groundwater contamination and to evaluate any cyclic trends in water quality that may affect contaminant migration.

Comments: In the event a well becomes dry while purging no sample will be taken. However, it should be recorded that no sample was collected because the well was dry.

Table C.18 MW66 monthly analytical parameters.

Field Parameters
Barometric Pressure
Specific Conductance
Depth to water
Dissolved Oxygen
Eh
pH
Temperature
Turbidity
Radionuclides
Alpha Activity
Beta Activity
Technetium-99
Volatiles
1,1,1-Trichloroethane
1,1,2-Trichloroethane
1,1-Dichloroethane
1,1-Dichloroethene
1,2-Dichloroethane
Benzene
Bromodichloromethane
Carbon Tetrachloride
Chloroform
cis-1,2-Dichloroethene
Dimethylbenzene, Total
Ethylbenzene
Tetrachloroethene
Toluene
trans-1,2-Dichloroethene
Trichloroethene
Vinyl Chloride

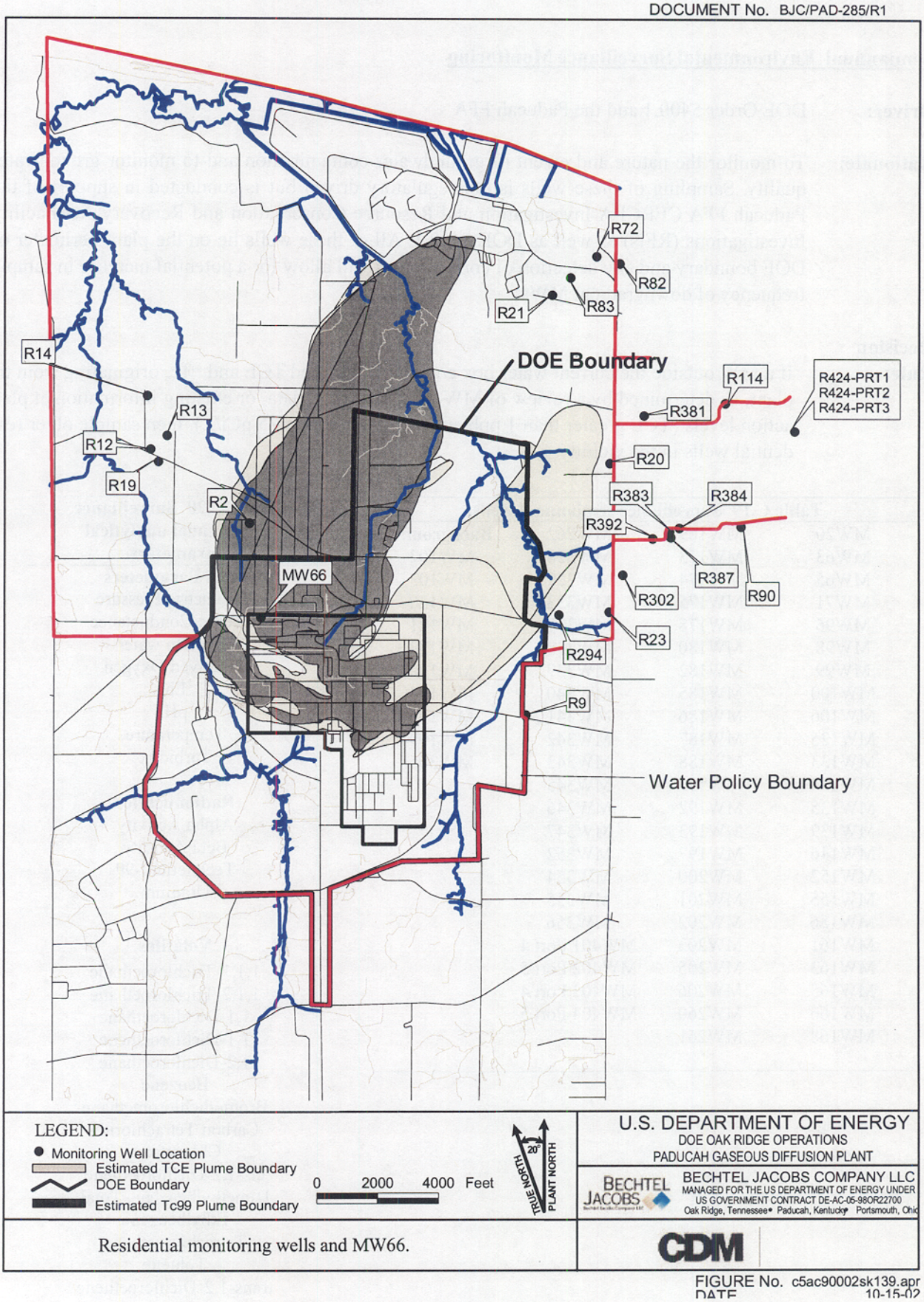

Figure C-5 Residential wells and MW66.

ENVIRONMENTAL SURVEILLANCE GROUNDWATER MONITORING PROGRAM

Semiannual Environmental Surveillance Monitoring

Driver: DOE Order 5400.1 and the Paducah FFA

Rationale: To monitor the nature and extent of groundwater contamination and to monitor groundwater quality. Sampling of these wells is not regulatory driven but is conducted in support of the Paducah FFA CERCLA Investigation and Resource Conservation and Recovery Act Facility Investigations (RFIs) as well as DOE 5400.1. All of these wells lie on the plant perimeter or DOE boundary and any detection of contaminants will allow for a potential increase in sample frequency of downgradient MWs.

Decision Rule: If a MW outside the current water box contains confirmed TCE and ^{99}Tc, originating from the plant, as determined by a review of MW data, historical data, or existing information at plant action levels (TCE greater than 1 ppb and ^{99}Tc greater than 25 pCi/L), then sample other residential wells in the vicinity.

Table C.19 Surveillance semiannual wells.

MW20	MW169	MW262	**Background**
MW63	MW173	MW328	MW102
MW65	MW174	MW329	MW103
MW71	MW175	MW333	MW120
MW96	MW178	MW337	MW121
MW98	MW180	MW338	MW122
MW99	MW182	MW339	MW150
MW100	MW185	MW340	MW194
MW106	MW186	MW341	MW196
MW125	MW187	MW342	MW199
MW133	MW188	MW343	MW305
MW134	MW191	MW345	
MW135	MW192	MW346	
MW139	MW193	MW347	
MW146	MW197	MW352	
MW152	MW200	MW354	
MW155	MW201	MW355	
MW156	MW202	MW356	
MW161	MW203	MW401 Port 4	
MW163	MW205	MW402 Port 5	
MW165	MW206	MW403 Port 4	
MW166	MW260	MW404 Port 5	
MW168	MW261		

Table C.20 Surveillance semiannual analytical parameters.

Field Parameters
Barometric Pressure
Specific Conductance
Depth to water
Dissolved Oxygen
Eh
pH
Temperature
Turbidity
Radionuclides
Alpha Activity
Beta Activity
Technetium-99
Uranium
Volatiles
1,1,1-Trichloroethane
1,1,2-Trichloroethane
1,1-Dichloroethane
1,1-Dichloroethene
1,2-Dichloroethane
Benzene
Bromodichloromethane
Carbon Tetrachloride
Chloroform
cis-1,2-Dichloroethene
Dimethylbenzene, Total
Ethylbenzene
Tetrachloroethene
Toluene
trans-1,2-Dichloroethene
Trichloroethene

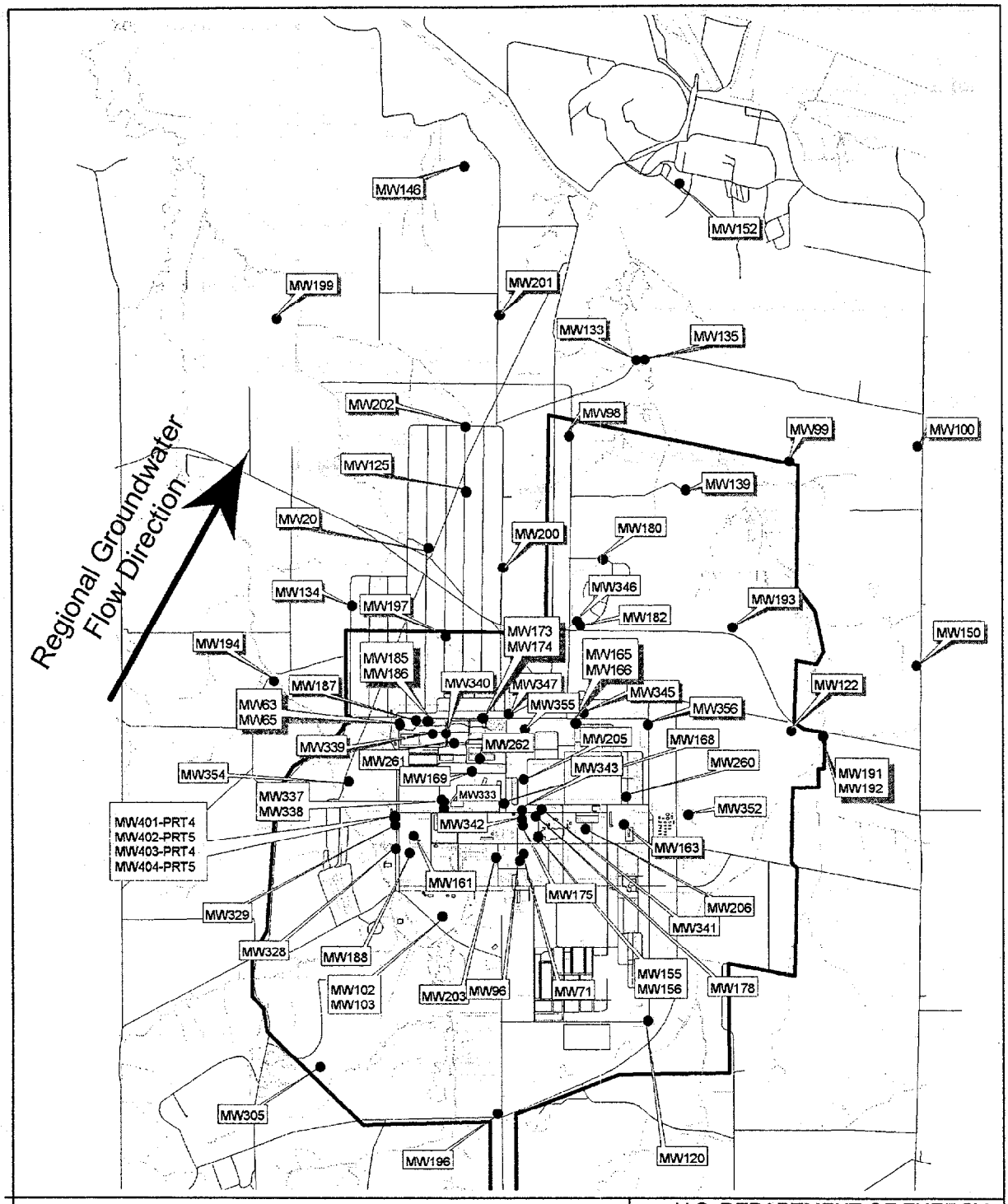

Figure C-6 Groundwater semiannual surveillance wells.

Natural Attenuation Semiannual Environmental Surveillance Monitoring

Driver: DOE Order 5400.1 and the Paducah FFA

Rationale: To monitor the nature and extent of groundwater contamination and to monitor groundwater quality. Sampling of these wells is not regulatory driven but is conducted in support of the FFA CERCLA Investigation and RFIs, as well as DOE 5400.1.

Table C.21 Surveillance attenuation wells.

MW20
MW99
MW100
MW125
MW134
MW152
MW161
MW163
MW188
MW193
MW206
MW201
MW260
MW328
MW329
MW401 Port 4
MW402 Port 5
MW403 Port 4
MW404 Port 5

Table C.22 Surveillance attenuation semiannual analytical parameters.

Other	**Metals**
Sulfate	Antimony
Nitrate	Barium
Total Organic Carbon	Beryllium
Chloride	Cadmium
	Calcium
Field Parameters	Chromium
Barometric Pressure	Cobalt
Specific Conductance	Copper
Depth to water	Iron
Dissolved Oxygen	Lead
Eh	Magnesium
pH	Manganese
Temperature	Molybdenum
Turbidity	Nickel
Alkalinity	Potassium
Ferrous Iron	Silver
	Zinc
	Arsenic
	Mercury
	Selenium
	Uranium

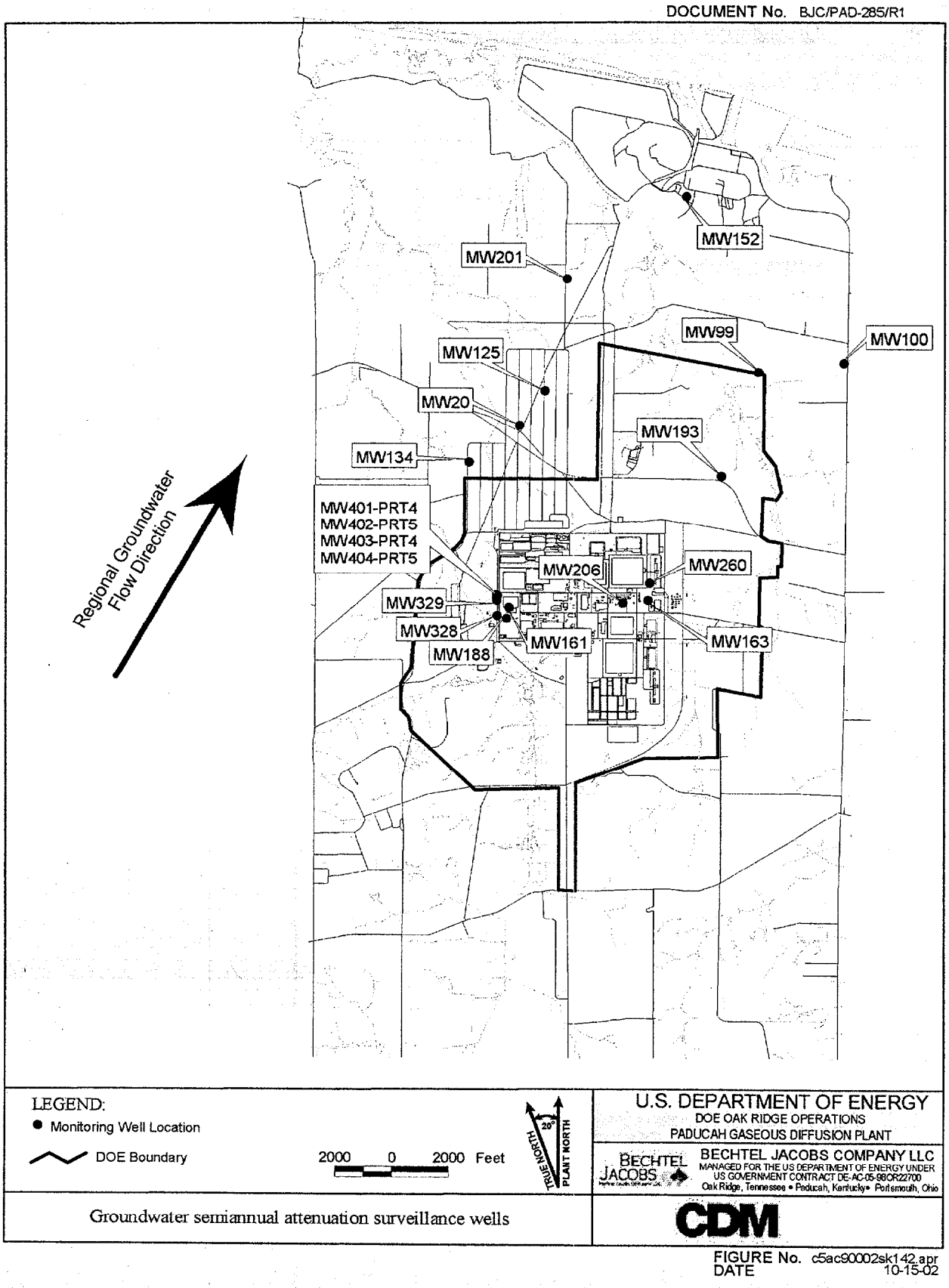

Figure C-7 Groundwater semiannual attenuation wells.

Annual Environmental Surveillance Radiological Monitoring

Wells: Groundwater Environmental Surveillance Semiannual Monitoring Program (Table C-19.)

C-746-K Landfill Groundwater Monitoring Program (Table C-7.)

MW66 Environmental Surveillance Groundwater Monitoring Program

Driver: DOE Order 5400.1 and the Paducah FFA

Rationale: If any MW indicates a hot spot in the regional gravel aquifer that has migrated beyond the DOE property boundary or has the potential to migrate and is not contained by an existing interim action, then consider whether an additional action is appropriate. If action is taken by an outside entity, then respond accordingly. If significant changes occur in MW concentrations and water levels, then reanalyze data and evaluate reason for change and assess impacts to remaining groundwater program.

Table C.23 Annual radiological analytical parameters.

Thorium-228
Thorium-230
Thorium-232
Thorium-234
Dissolved Alpha
Dissolved Beta
Suspended Alpha
Suspended Beta
Potassium-40
% U-235
Uranium
Uranium-234
Uranium-235
Uranium-238

C2. SURFACE WATER, SEDIMENT, AND WATERSHED BIOLOGICAL MONITORING

EFFLUENT WATERSHED MONITORING PROGRAM

C-746-S & -T Landfills and C-746-U Landfill Surface Water

Frequency: Quarterly

Driver: This monitoring is specified in the landfill permits issued by KDWM.

Rationale: To monitor rain runoff from the C-746-S& -T and C-746-U Landfills.

Table C.24 Landfill surface water locations.

C-746-S&T	C-746-U
L135	L150
L136	L154
L137	L155

Table C.25 Landfill surface water parameters.

Anions
Chloride
Sulfate

Field Measurements
Specific Conductance
Dissolved Oxygen
Flow Rate
pH
Temperature

Metals
Iron
Sodium
Uranium

Other
Total Dissolved Solids
Total Suspended Solids
Total Solids
COD
Total Organic Carbon

Radionuclides
Alpha Activity
Beta Activity

KPDES Outfall Sampling

Driver: DOE KPDES Permit for the Paducah Gaseous Diffusion Plant, Permit Number KY0004049, McCracken County, Kentucky.

Comments: A new KPDES permit will be issued in April 2003. The required parameters will be outlined in the new permit and may be different than the current parameters.

Table C.26 KPDES parameters (K001, K015 and K017).

K001 Weekly	K001 Monthly	K001 Quarterly
Specific Conductance	PCB, Total	Antimony
Dissolved Oxygen	PCB-1016	Arsenic
Flow Rate	PCB-1221	Beryllium
pH	PCB-1232	Cadmium
Temperature	PCB-1242	Chromium
Total Residual Chlorine	PCB-1248	Copper
Phosphorus	PCB-1254	Iron
Oil and Grease	PCB-1260	Lead
	PCB-1268	Nickel
	Trichloroethene	Selenium
	Hardness-Total as CaCO3	Silver
		Thallium
		Total Recoverable Metals
		Zinc
		Mercury
		Dissolved Alpha
		Dissolved Beta
		Suspended Alpha
		Suspended Beta
		Uranium-235
		Uranium
		Technetium-99
		Flow
		Temperature
		Chronic Toxicity
	K015 and K017 Monthly	**K015 and K017 Quarterly**
	Specific Conductance	Antimony
	Dissolved Oxygen	Arsenic
	Flow Rate	Beryllium
	pH	Cadmium
	Temperature	Chromium
	PCB, Total	Copper
	PCB-1016	Iron
	PCB-1221	Lead
	PCB-1232	Nickel
	PCB-1242	Selenium
	PCB-1248	Silver
	PCB-1254	Thallium
	PCB-1260	Total Recoverable Metals
	PCB-1268	Zinc
	Oil and Grease	Mercury
	Hardness-Total as CaCO3	Dissolved Alpha
		Dissolved Beta
		Suspended Alpha
		Suspended Beta
		Uranium-235
		Uranium
		Technetium-99
		Flow
		Temperature
		Acute Toxicity

Table C.27 KPDES parameters (K019).	
K019 Monthly	**K019 Quarterly**
Specific Conductance	Antimony
Dissolved Oxygen	Arsenic
Flow Rate	Beryllium
pH	Cadmium
Temperature	Chromium
PCB, Total	Copper
PCB-1016	Iron
PCB-1221	Lead
PCB-1232	Nickel
PCB-1242	Selenium
PCB-1248	Silver
PCB-1254	Thallium
PCB-1260	Total Recoverable Metals
PCB-1268	Zinc
Oil and Grease	Mercury
Hardness-Total as CaCO3	Dissolved Alpha
Total Suspended Solids	Dissolved Beta
	Suspended Alpha
	Suspended Beta
	Uranium-235
	Uranium
	Technetium-99
	Flow Rate
	Temperature
	Acute Toxicity

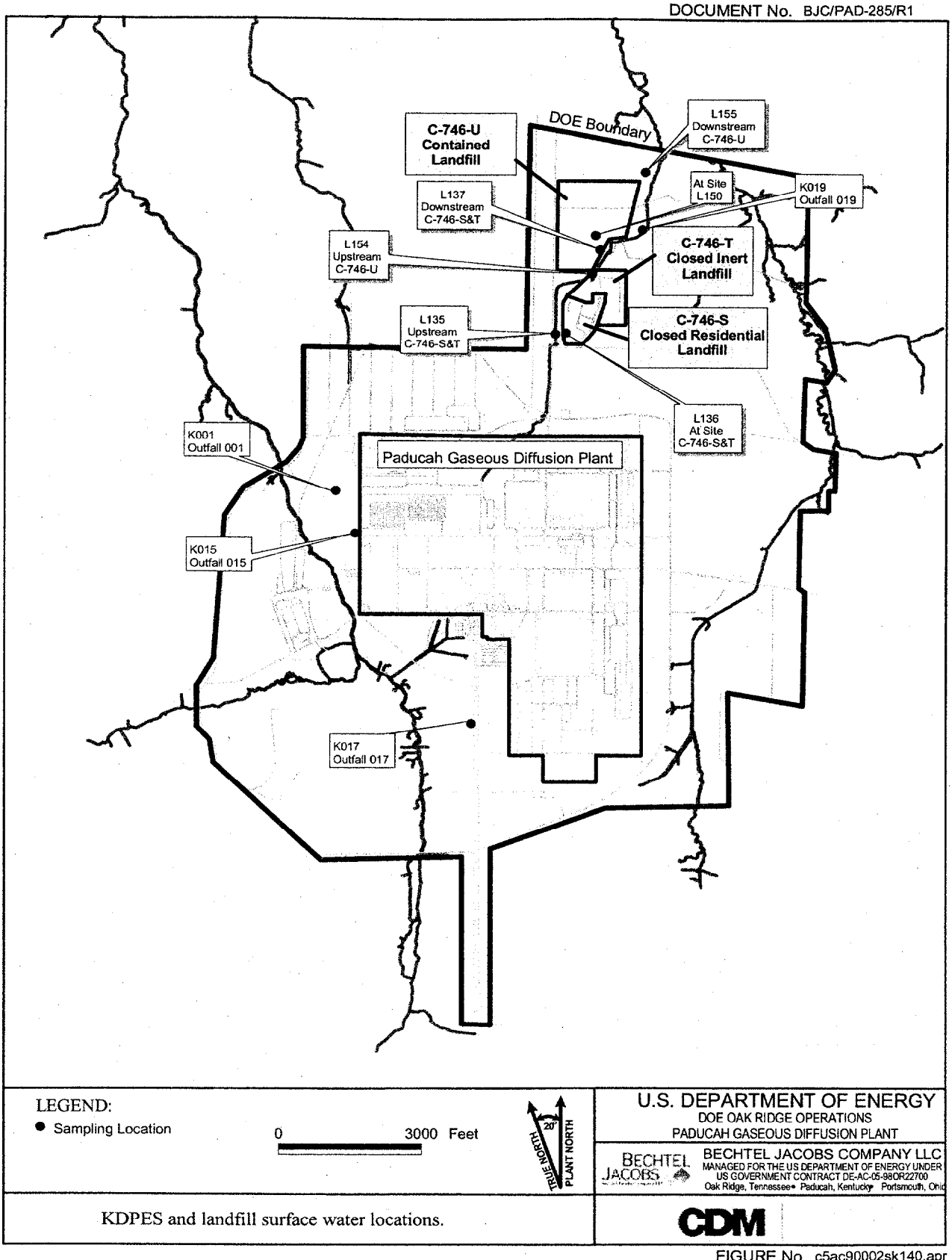

Figure C-8 KPDES and landfill surface water locations.

Watershed KPDES Permit Biological Sampling

Locations: Areas outside of the PGDP security fence and the West Kentucky Wildlife Management Area (WKWMA) and reference from a specified background location. (See field and analytical parameters below for location names and Figure C-9 for a map of the locations.)

Driver: DOE KPDES Permit for the Paducah Gaseous Diffusion Plant, Permit Number KY0004049, McCracken County, Kentucky.

Frequency: Annually

Comments: A new KPDES permit will be issued in April 2003. The required watershed monitoring will be outlined in the new permit and may be different than the current parameters.

Table C.28 Watershed monitoring locations and analyses.

Type of Monitoring	Analyses	Locations
Bioaccumulation	Percent Lipids	BM 6.2
	PCB Aroclors	LUM 2.7
		LUM 4.2
		LUM 5.0
		MAM 8.6
Benthic Macroinvertebrates Multi-habitat Assessment	Taxonomic Level	BM 5.55
	Total Density	BM 5.85
	Total Biomass	BM 6.2
		UTM 6.9
		BM 7.6
		LUM 4.2
		LUM 5.0
		LUM 6.6
		MAM 8.6
Fish Community Ecological Health	Species Richness	BM 5.55
		BM 5.85
		BM 6.2
		UTM 6.9
		BM 7.6
		LUM 4.2
		LUM 5.0
		LUM 6.6
		MAM 8.6

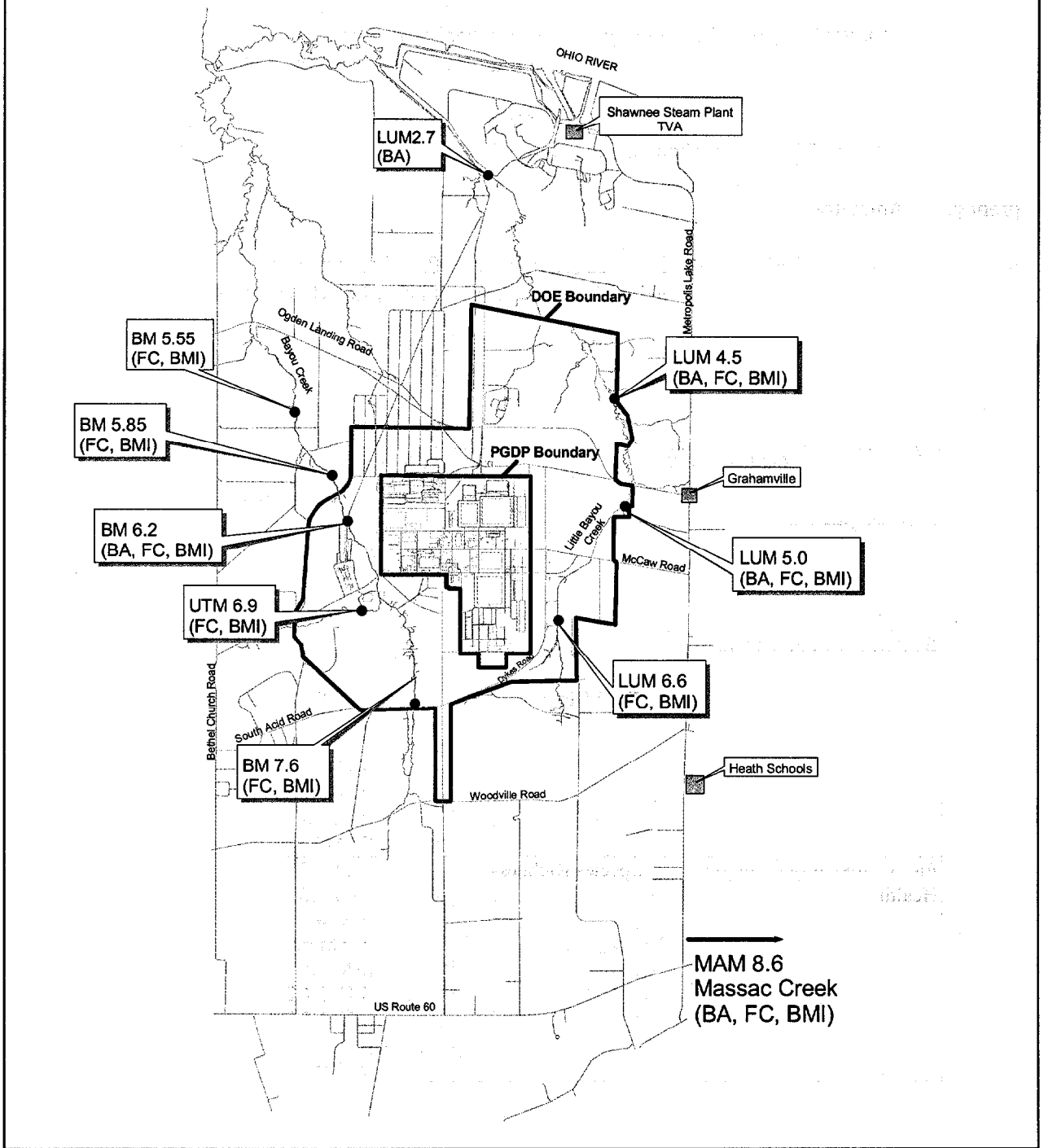

Figure C-9 Watershed monitoring locations.

Quarterly Surface Water Monitoring

Driver: DOE Order 5400.1.

Rationale: To monitor the nature and extent of potential contamination released into Bayou Creek and Little Bayou Creek surface water related to historical plant operations.

Table C.29 Surface water sampling locations.

Surface Water
C612
C616
C746K-5
C746KTB1
C746KTB2
C746KUP
K002
K006
K016
L1
L10
L11
L194
L29
L291
L30
L306
L5
L56
L12
L241
L55
L6
L64
L8
Seeps
LBCSP1
LBCSP2
LBCSP3
LBCSP4
LBCSP5
LBCSP6

Table C.30 Surface water quarterly analytical parameters.

Radiological	Metals
Dissolved Alpha	Aluminum
Dissolved Beta	Antimony
Suspended Alpha	Barium
Suspended Beta	Beryllium
Technetium-99	Cadmium
Neptunium-237	Calcium
Plutonium-238	Chromium
Pu-239/240	Cobalt
Thorium-228	Copper
Thorium-230	Iron
Thorium-232	Lead
Thorium-234	Magnesium
% U-235	Manganese
Americium-241	Nickel
Cesium-134	Potassium
Cesium-137	Silver
Cobalt-60	Sodium
K-40	Thallium
Uranium	Uranium
Uranium-234	Vanadium
Uranium-235	Zinc
Uranium-238	Arsenic
	Mercury
PCBs	Selenium
PCB, Total	
PCB-1016	**Miscellaneous**
PCB-1221	Hardness-Total as CaCO3
PCB-1232	Total Suspended Solids
PCB-1242	Turbidity
PCB-1248	Chloride
PCB-1254	Ammonia as Nitrogen
PCB-1260	Nitrogen as Nitrate/Nitrite
PCB-1268	Phosphorous
	Cyanide
Field Measurements	
pH	**Volatiles**
Dissolved Oxygen	Trichloroethene
Temperature	
Specific Conductance	
Alkalinity	

Table C.31 Quarterly seep location analytical parameters.

Radionuclides
Alpha Activity
Beta Activity
Technetium-99
Uranium
Volatiles
1,1,1-Trichloroethane
1,1,2-Trichloroethane
1,1-Dichloroethane
1,1-Dichloroethene
1,2-Dichloroethane
Benzene
Bromodichloromethane
Carbon Tetrachloride
Chloroform
cis-1,2-dichloroethene
Dimethylbenzene, Total
Ethylbenzene
Tetrachloroethene
Toluene
Trans-1,2-Dichloroethene
Trichloroethene
Vinyl Chloride
Field Measurements
pH
Dissolved Oxygen
Temperature
Specific Conductance
Alkalinity
Other
Sodium
Potassium
Calcium
Magnesium
Manganese
Chloride
Sulfate

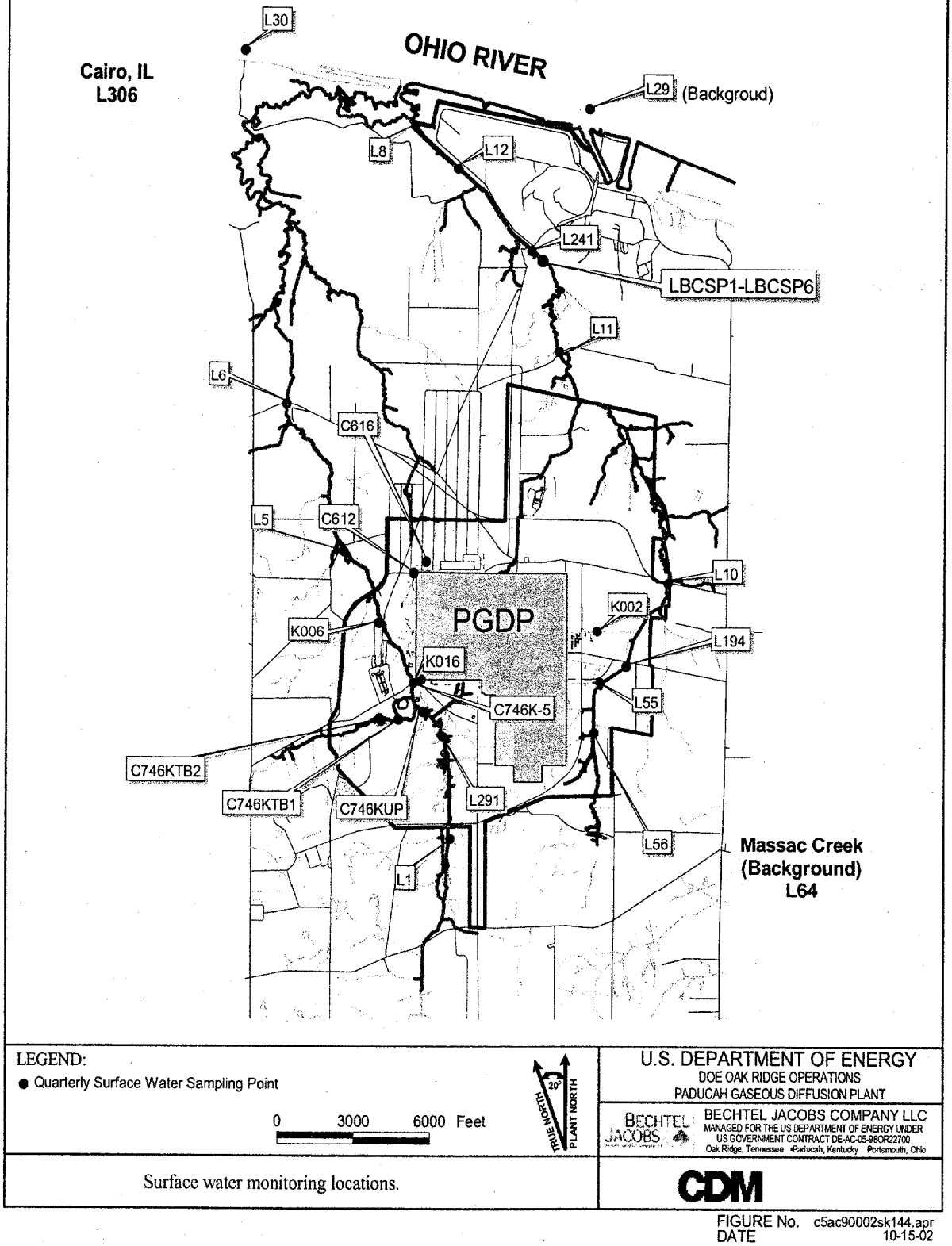

Figure C-10 Surface water monitoring locations.

Semiannual Sediment Monitoring

Driver: DOE Order 5400.1.

Rationale: To monitor the nature and extent of potential contamination released into Bayou Creek and Little Bayou Creek sediments related to historical plant operations.

Table C.32 Sediment sampling locations.

C612
C616
C746KTB2
C746KUP
K001
S1
S2
S20
S21
S27
S28
S30
S31
S32
S33
S34

Table C.33 Sediment semiannual analytical parameters.

PCBs	**Metals**
PCB, Total	Aluminum
PCB-1016	Antimony
PCB-1221	Barium
PCB-1232	Beryllium
PCB-1242	Cadmium
PCB-1248	Calcium
PCB-1254	Chromium
PCB-1260	Cobalt
PCB-1268	Copper
	Iron
Radiological	Lead
Uranium	Magnesium
% Uranium-235	Manganese
Uranium-234	Nickel
Uranium-235	Potassium
Uranium-238	Silver
Alpha activity	Sodium
Beta activity	Thallium
Technetium-99	Uranium
Plutonium-239/240	Vanadium
Thorium-230	Zinc
Americium-241	Arsenic
Cesium-137	Mercury
Cobalt-60	Selenium
Neptunium-237	
Potassium-40	**Miscellaneous**
	Grain Size
	Moisture
	Total Organic Carbon

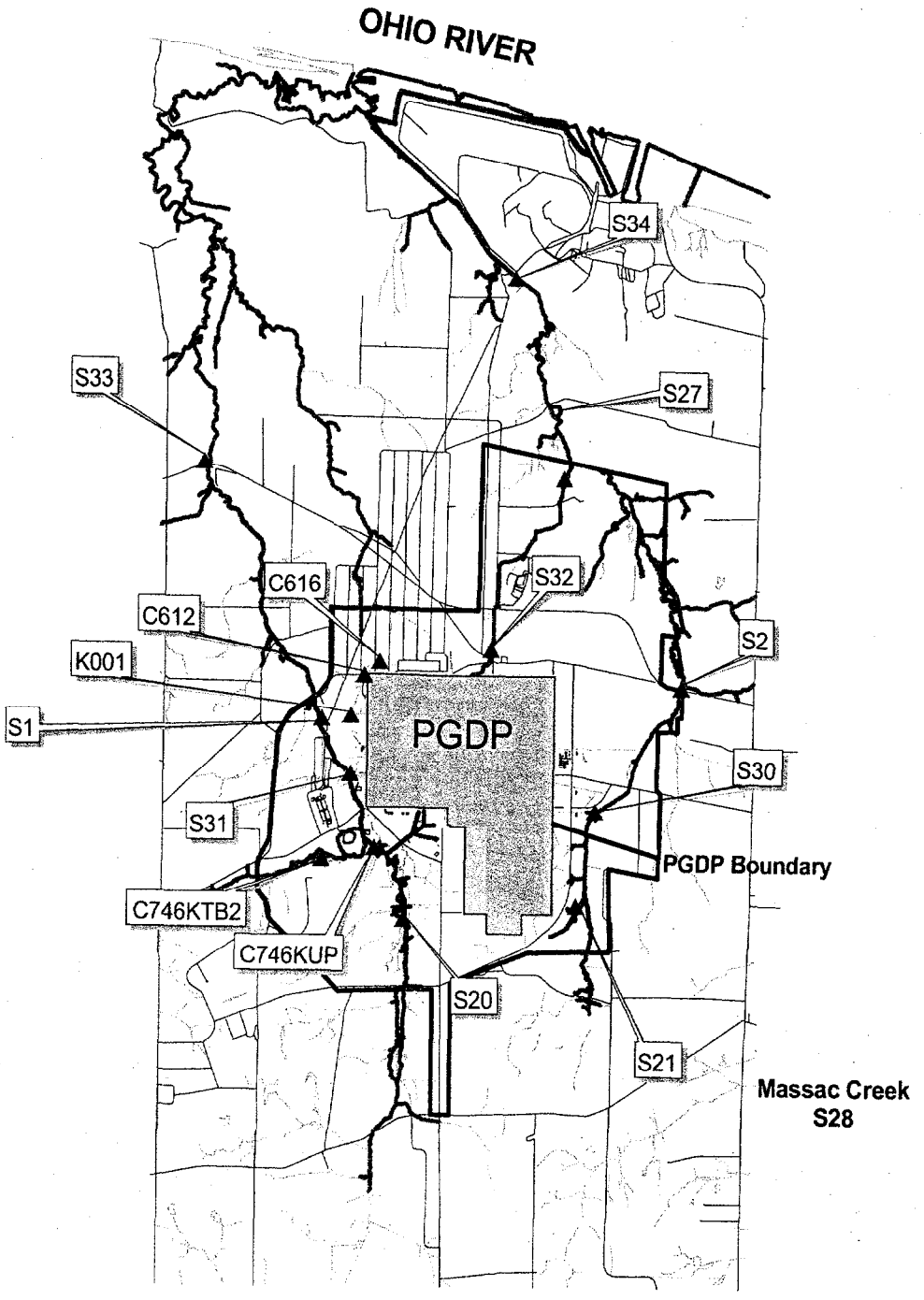

Figure C-11 Semiannual sediment locations.

C3. ANNUAL DEER HARVESTING

Locations: Areas outside of the PGDP security fence and the WKWMA and reference deer from a specified background location.

Driver: DOE Order 5400.1.

Rationale: Evaluate data for risk assessment each year to determine if health would be impacted from eating deer collected during the hunting season. If risk is elevated, then notify the WKWMA personnel to take appropriate action.

Table C.34 Annual deer sampling parameters.

Liver and Muscle	Fat (rump and abdominal) and Liver	Kidney
Aluminum	Percent Lipids	Aluminum
Antimony	PCB Aroclors	Antimony
Barium		Barium
Beryllium	**Bone**	Beryllium
Cadmium	Technetium-99	Cadmium
Chromium	Neptunium-237	Chromium
Cobalt	Plutonium-239	Cobalt
Copper	Uranium-234	Copper
Iron	Uranium-235	Iron
Lead	Uranium-238	Lead
Manganese	Thorium-230	Manganese
Nickel		Nickel
Silver	**Thyroid**	Silver
Thallium	Technetium-99	Thallium
Vanadium		Vanadium
Zinc		Zinc
Arsenic		Arsenic
Mercury		Mercury
Selenium		Selenium
Technetium-99		
Neptunium-237		
Plutonium-239		
Uranium-234		
Uranium-235		
Uranium-238		
Thorium-230		

C4. LANDFILL LEACHATE SAMPLING

C-746-S & -T Landfills Leachate Monitoring

Frequency: Annual

Driver: Sampling requirements are outlined in the landfill permits issued by KDWM.

Table C.35 C-746-S and T Landfills leachate analytical parameters.

Volatiles	Anions	Metals
1,1,1,2-Tetrachloroethane	Bromide	Aluminum
1,1,1-Trichloroethane	Chloride	Antimony
1,1,2,2-Tetrachloroethane	Fluoride	Arsenic
1,1,2-Trichloroethane	Nitrate as Nitrogen	Barium
1,1-Dichloroethane	Sulfate	Beryllium
1,1-Dichloroethene		Boron
1,2,3-Trichloropropane	**Miscellaneous**	Cadmium
1,2-Dibromo-3-chloropropane	Suspended Solids	Calcium
1,2-Dibromoethane	Iodide	Chromium
1,2-Dichlorobenzene	Hardness-Total as CaCO3	Cobalt
1,2-Dichloroethane	COD	Copper
1,2-Dichloropropane	CBOD	Iron
1,4-Dichlorobenzene	Cyanide	Lead
2-Butanone	Total Organic Carbon	Magnesium
2-Chloroethyl Vinyl Ether	TOX	Manganese
2-Hexanone	Uranium	Mercury
4-Methyl-2-pentanone		Molybdenum
Acetone	**PCBs**	Nickel
Acrolein	PCB, Total	Phosphorous
Acrylonitrile	PCB-1016	Potassium
Benzene	PCB-1221	Rhodium
Bromochloromethane	PCB-1232	Selenium
Bromodichloromethane	PCB-1242	Silver
Bromoform	PCB-1248	Sodium
Bromomethane	PCB-1254	Tantalum
Carbon Disulfide	PCB-1260	Thallium
Carbon Tetrachloride	PCB-1268	Tin
Chlorobenzene		Titantium
Chloroethane	**Radionuclides**	Vanadium
Chloroform	Activity of U-235	Zinc
Chloromethane	Alpha Activity	
cis-1,2-Dichloroethene	Americium-241	**Field Parameters**
cis-1,3-Dichloropropene	Beta Activity	Specific Conductance
Dibromochloromethane	Cesium-137	Dissolved Oxygen
Dibromomethane	Cobalt-60	pH
Dichlorodifluoromethane	Iodine-131	RedOx
Dimethylbenzene, Total	Neptunium-237	Temperature
Ethanol	Plutonium-239/240	
Ethyl Methacrylate	Radium	
Ethylbenzene	Strontium-90	
Iodomethane	Technetium-99	
Methylene Chloride	Thorium-230	
Styrene	Tritium	
Tetrachloroethene	Uranium	
Toluene	Uranium-234	
trans-1,2-Dichloroethene	Uranium-235	
trans-1,3-Dichloropropene	Uranium-238	
trans-1,4-Dichloro-2-Butene		
Trichloroethene		
Trichlorofluoromethane		
Vinyl Acetate		
Vinyl Chloride		

C-746-U Contained Landfill Leachate Monitoring

Frequency: Annual

Driver: Sampling requirements are outlined in the landfill permit issued by KDWM.

Table C.36 C-746-U Landfill leachate analytical parameters.

Volatiles	Anions	Metals
1,1,1,2-Tetrachloroethane	Bromide	Aluminum
1,1,1-Trichloroethane	Chloride	Antimony
1,1,2,2-Tetrachloroethane	Fluoride	Arsenic
1,1,2-Trichloroethane	Nitrate as Nitrogen	Barium
1,1-Dichloroethane	Sulfate	Beryllium
1,1-Dichloroethene		Boron
1,2,3-Trichloropropane	**Miscellaneous**	Cadmium
1,2-Dibromo-3-chloropropane	Dissolved Solids	Calcium
1,2-Dibromoethane	Suspended Solids	Chromium
1,2-Dichlorobenzene	Iodide	Cobalt
1,2-Dichloroethane	Oil and Grease	Copper
1,2-Dichloropropane	Hardness-Total as CaCO3	Iron
1,4-Dichlorobenzene	COD	Lead
2-Butanone	CBOD	Magnesium
2-Chloroethyl Vinyl Ether	Cyanide	Manganese
2-Hexanone	Total Organic Carbon	Mercury
4-Methyl-2-pentanone	TOX	Molybdenum
Acetone	Uranium	Nickel
Acrolein		Phosphorous
Acrylonitrile	**PCBs**	Potassium
Benzene	PCB, Total	Rhodium
Bromochloromethane	PCB-1016	Selenium
Bromodichloromethane	PCB-1221	Silver
Bromoform	PCB-1232	Sodium
Bromomethane	PCB-1242	Tantalum
Carbon Disulfide	PCB-1248	Thallium
Carbon Tetrachloride	PCB-1254	Tin
Chlorobenzene	PCB-1260	Titantium
Chloroethane	PCB-1268	Vanadium
Chloroform		Zinc
Chloromethane	**Radionuclides**	
cis-1,2-Dichloroethene	Activity of U-235	**Field Parameters**
cis-1,3-Dichloropropene	Alpha Activity	Specific Conductance
Dibromochloromethane	Americium-241	Dissolved Oxygen
Dibromomethane	Beta Activity	pH
Dichlorodifluoromethane	Cesium-137	RedOx
Dimethylbenzene, Total	Cobalt-60	Temperature
Ethanol	Iodine-131	
Ethyl Methacrylate	Neptunium-237	
Ethylbenzene	Plutonium-239/240	
Iodomethane	Radium	
Methylene Chloride	Strontium-90	
Styrene	Technetium-99	
Tetrachloroethene	Thorium-230	
Toluene	Tritium	
trans-1,2-Dichloroethene	Uranium	
trans-1,3-Dichloropropene	Uranium-234	
trans-1,4-Dichloro-2-Butene	Uranium-235	
Trichloroethene	Uranium-238	
Trichlorofluoromethane		
Vinyl Acetate		
Vinyl Chloride		

C-404 Low-level Radioactive Waste Burial Ground Leachate Monitoring

Frequency: As needed

Driver: The leachate parameters are required to be sampled per the Environmental Protection Agency (EPA) Hazardous Waste Permit Number KY 8-890-008-982.

Table C.37 C-404 Landfill leachate analytical parameters.

Volatiles	Metals
Trichloroethene	Barium
	Cadmium
Radionuclides	Chromium
Technetium-99	Copper
Uranium-234	Iron
Uranium-235	Lead
Uranium-238	Nickel
Plutonium-239	Silver
Thorium-230	Zinc
Cesium-137	Arsenic
Neptunium-237	Mercury
	Selenium
PCBs	Uranium
PCB, Total	
PCB-1016	**Other**
PCB-1221	Fluoride
PCB-1232	Ammonia as Nitrogen
PCB-1242	
PCB-1248	
PCB-1254	
PCB-1260	
PCB-1269	

C5. EXTERNAL GAMMA RADIOLOGICAL MONITORING

Frequency: Continuously: Forty-six (46) monitoring locations changed quarterly for gamma radiation monitoring. Six (6) locations also include a neutron monitor.

Driver: DOE Order 5400.1

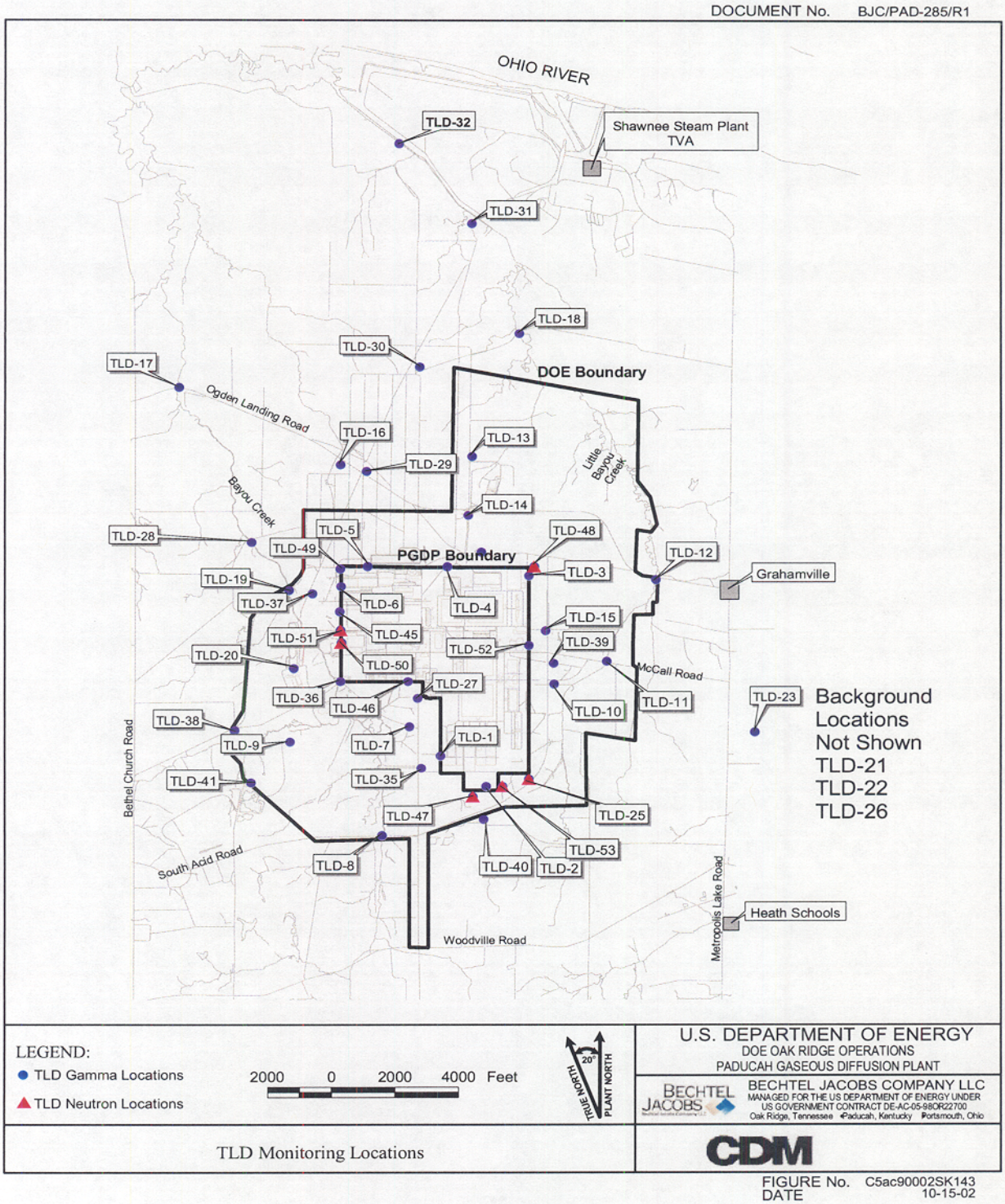

Figure C-12 TLD monitoring locations.

APPENDIX D

ENVIRONMENTAL SERVICES
QUALITY ASSURANCE AND DATA MANAGEMENT PLAN

ENVIRONMENTAL SERVICES
QUALITY ASSURANCE AND DATA MANAGEMENT PLAN

Date Issued—November 2002

Prepared by
CDM Federal Services Inc.
under subcontract 23900-SC-RM056F-00
Document Control No. 1701-201-QA-399
Revision 2

Prepared for

BECHTEL JACOBS COMPANY LLC
managing the
Environmental Management Activities at the
Paducah Gaseous Diffusion Plant
Under Contract DE-AC05-98OR22700
for the
U.S. DEPARTMENT OF ENERGY

INTRODUCTION

The following plan serves as the quality assurance and data management plan for Environmental Services as managed by CDM Federal Services Inc. This plan describes the quality assurance and data management requirements for sampling and analysis of environmental media, including groundwater, surface water, sediment and tissue, as well as external gamma radiation monitoring, ecological and bioaccumulation monitoring.

ENVIRONMENTAL SERVICES
QUALITY ASSURANCE AND DATA MANAGEMENT PLAN

APPROVALS

Prepared by: Signature in original plan Date: _____
C.A. Frank
CDM Federal Services Inc.
Quality Assurance

Approved by: Signature in original plan Date: _____
T. L. Brindley
CDM Federal Services Inc.
Project Manager

Approved by: Signature in original plan Date: _____
D. O. Johnson
CDM Federal Services Inc.
QA Manager

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LAN-CON Environmental

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D. F. Hutcheson
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ACRONYMS

ACO	Administrative Consent Order
AOC	Area of Concern
BBC	Bayou Creek
BJC	Bechtel Jacobs Company LLC
CFR	Code of Federal Regulations
COC	Chain-of-Custody
DMC	Document Management Center
DM	Data Management
DMR-QA	Discharge Monitoring Report – Quality Assurance
DO	Dissolved Oxygen
DOE	Department of Energy
DQO	Data Quality Objective
EDD	Electronic Data Deliverable
EMP	Environmental Monitoring Plan
EPA	Environmental Protection Agency
ES	Environmental Services
ESS	Environmental Services Subcontract
FFA	Federal Facilities Agreement
HSWA	Hazardous Solid Waste Amendment
KDEP	Kentucky Department for Environmental Protection
KPDES	Kentucky Pollutant Discharge Elimination System
LBC	Little Bayou Creek
MCL	Maximum Contaminant Level
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OREIS	Oak Ridge Environmental Information System
OSHA	Occupational Safety and Health Administration
PARCCS	Precision, Accuracy, Representativeness, Comparability, Completeness, and Sensitivity
PCB	Polychlorinated Biphenyl
PDCC	Project Document Control Center
PEMS	Project Environmental Measurements System
PGDP	Paducah Gaseous Diffusion Plant
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RGA	Regional Gravel Aquifer
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SMO	Sample Management Organization
SOW	Statement of Work
STR	Subcontract Technical Representative
SWMU	Solid Waste Management Units
^{99}Tc	Technetium-99
TCE	Trichloroethene
TCL	Target Compound List
USEC	United States Enrichment Corporation
VOC	Volatile Organic Compound

A1. INTRODUCTION TO THE QUALITY PROGRAM

The Environmental Services Subcontract (ESS), managed by CDM Federal Services Inc. and its subcontractors for Bechtel Jacobs Company LLC (BJC) performs environmental monitoring, effluent monitoring, environmental surveillance, and compliance reporting. The ESS Quality Assurance and Data Management (QA/DM) Plan describes the responsibilities and activities that affect the quality of the operations, maintenance, and scientific and technical information collected. This plan is a stand-alone project plan that supports and is included as an attachment to the *Environmental Monitoring Plan* (EMP), BJC/PAD-121. The EMP provides overall direction for ESS activities.

The CDM Federal QA Program has been prequalified by BJC. The CDM Federal QA Program, documented in the CDM Federal Programs Corporation Quality Assurance Manual, and this project QA/DM Plan are in compliance with 10 CFR 830.120. The CDM Federal Programs Corporation Quality Assurance Manual provides additional program requirements concerning quality assurance. The ten elements of 10 CFR 830.120 discussed within the CDM Federal QA Program are as follows:

10 CFR 830.120 Criteria	ESS QA/DM Plan
i – Program	Section A1
ii – Personnel Training and Qualification	Section A6
iii – Quality Improvement	Sections C
iv – Documents and Records	Section A7
v – Work Processes	Section B
vi – Design	CDM Federal Programs Quality Assurance Manual
vii – Procurement	Section B8
viii– Inspection and Acceptance Testing	Section B6
ix – Management Assessment	Section C
x – Independent Assessment	Section C

Environmental Services is focused on obtaining environmental data and measurements; therefore, this plan identifies quality assurance requirements consistent with Environmental Protection Agency QA/R-5, *Requirements for Quality Assurance Project Plans for Environmental Data Operations* (QA/R-5). Each QA/R-5 element is identified following section headings. This plan will be updated through an annual review and revised as necessary. All revisions to the QA/DM plan will be subject to the CDM Federal internal review process. The QA/DM plan will also be submitted for review and acceptance by BJC.

Reference Documents

- BJC/PAD-285, *Environmental Monitoring Plan*
- Kentucky Pollutant Discharge Elimination System (KPDES) Permit, KY0004049, October 1992
- KPDES Landfill Permit, KY0100072, August 1995
- KY8-890-008-982, Hazardous Solid Waste Amendments (HSWA) Permit, October 1987
- 10 Code of Federal Regulations (CFR) 830.120, *Quality Assurance Requirements*
- Department of Energy (DOE) O414.1, *Quality Assurance*
- Environmental Protection Agency (EPA) QA/R-5, *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations*
- SW-846, *Test Methods for Evaluating Solid Waste*
- CDM Federal Programs Corporation Quality Assurance Manual

A2. PROJECT/TASK ORGANIZATION AND RESPONSIBILITY

A2.1 PROJECT PERSONNEL

The Organizational Chart for Environmental Services is shown in Attachment 1. The organization is designed to provide a clear line of functional and program responsibility and authority supported by a management control structure. Overall responsibilities include:

- establishing clearly defined lines of communication and coordination (Project Manager);
- monitoring project budget and schedule (Project Manager);
- providing progress reports (Project Manager);
- establishing quality control (Quality Assurance Coordinator);
- ensuring health and safety (Project Manager);
- ensuring project coordination (Project Manager); and
- maintaining project database (Data Coordinator and Sampling Data Coordinator).

A2.2 RESPONSIBILITIES

A2.2.1 Project Manager

The Project Manager reports to the Site Manager and is responsible for implementation of all activities associated with the ESS such as maintaining budgets, schedules, and milestones. The Project Manager has direct responsibility for project oversight, issuing technical reports, and maintaining that the project is on schedule and within budget. The Project Manager ensures that implementation of the QA and Health and Safety Programs are consistent with DOE guidelines. The Project Manager responds to QA/quality control (QC) deficiencies, initiates corrective actions, and ensures data management requirements are followed.

A2.2.2 Environmental Sampling Task Lead

The Environmental Sampling Task Lead is responsible for providing technical support to the ESS by generating required reports and making decisions regarding technical issues (i.e., sample locations, analytical methods, etc.). The Environmental Sampling Task Lead is also responsible for ensuring that the monitoring activities are consistent with the site-wide groundwater program and other environmental monitoring policies and procedures. The Environmental Sampling Task Lead is also responsible for managing and administering projects; planning activities; and procuring services, as necessary.

A2.2.3 Field Operations Manager

The Field Operations Manager reports to Environmental Sampling Task Lead is responsible for overseeing routine monitoring/sampling activities; maintaining and inspecting monitoring equipment; coordinating split sampling activities with the state of Kentucky; overseeing procedures; and ensuring visitor and worker safety and health on the project site.

A2.2.4 Environmental Monitoring Specialists

The Environmental Monitoring Specialists report to the Field Operations Manager and are responsible for all groundwater monitoring, KPDES, surface water, and sediment sampling activities which include the following: maintaining logbook entries; calibrating monitoring equipment; performing field analyses; maintaining sampling equipment; performing well inspections; conducting all routine monthly, quarterly, semiannual, and annual sampling, as well as special, residential, and state of Kentucky split sampling; preserving samples; and maintaining quality records of sampling events in written format.

A2.2.5 Sampling Data Coordinator

The Sampling Data Coordinator reports to the Field Operations Manager and ensures that all data is entered into Environmental Services (ES) Project Environmental Measurements System (PEMS), including chain-of-custody (COC) information, field data, results of QC checks, and any pertinent information recorded by the Environmental Monitoring Specialists. The Sampling Data Coordinator is responsible for overseeing the performance of necessary calibrations; decontaminating sampling equipment; performing laboratory inspections; maintaining an inventory list of reagents and chemicals; and managing and reviewing records and logbooks.

A2.2.6 Data Coordinator

The Data Coordinator reports to the Project Manager and is responsible for ensuring that the requirements relating to data management are met for the project, which includes the accumulation, control and storage of data as part of the project. The Data Coordinator ensures that the data are entered into the project database, loads Electronic Data Deliverables (EDDs) to ES PEMS, performs electronic verification of data, acoordinates/tracks the data validation and assessment process, and prepares data for transfer from ES PEMS to the Paducah Oak Ridge Environmental Information System (OREIS). Data files are transmitted via email to the BJC Data Manager with a copy to the BJC Subcontract Technical Representative (STR). Upon completion of the project, the Data Coordinator transmits project data files to BJC STR and Data Manager.

A2.2.7 Quality Assurance Coordinator

The QA Coordinator reports to the Project Manager and the CDM Federal QA Manager and is responsible for preparing quality assurance project plans; conducting a review of documents, plans, procedures, and data; performing audits, surveillances, and self assessments.

A2.2.8 Records Coordinator

The Records Coordinator is responsible for maintaining and preserving pertinent and required records associated with operating the satellite document management centers (DMCs). The Records Coordinator is responsible for the project records, which includes activities relating to identification, acquisition and storage of project records related to field activities. The Records Coordinator is also responsible for determining which records must be stored and the storage requirements; entering records; implementing a storage and retrieval system; maintaining the project records; and performing data updates and deletions. The Records Coordinator is responsible for maintaining a "COPY" file of project records at an alternate location and copying project records for that file.

A.2.2.9 Reports Coordinator

The Reports Coordinator is responsible for coordinating the ESS documents and reports and maintaining working copies.

A2.2.10 Environmental Compliance Task Lead

The Environmental Compliance Task Lead is responsible for establishing regulatory compliance requirements; assisting in implementation, planning, and oversight of regulatory compliance; and providing assistance on conducting data assessment for the Environmental Compliance Technical Representatives.

A2.2.11 Environmental Compliance Technical Representatives

The Environmental Compliance Technical Representatives are responsible for preparing required reports; technically assessing data; and providing technical environmental compliance support as needed.

A2.2.12 BJC STR

The BJC STR is responsible for implementation of all activities associated with the ESS and has direct responsibility for project oversight. The BJC STR coordinates the project and communicates regularly with the Project Manager and project personnel on project budget, schedule, and technical status.

A.2.2.13 BJC Data Manager

The BJC Data Manager is responsible for long-term storage of project data and for transmitting data to external agencies according to the Paducah Site Data Management Plan (DOE/OR/07-1595&D1) and the Paducah Data Management Policy. The Data Manager ensures compliance to policies and procedures relating to data management with respect to the project. The BJC Data Manager notifies the ESS Data Coordinator of the availability of analytical data.

A.2.2.14 BJC Sample Manager

The BJC Sample Manager is responsible for contracting any fixed-base laboratory utilized during the ESS activities. The BJC Sample Manager also provides coordination for sample shipment to the laboratory, contractual screening of data packages, and transmittal of data packages to the Paducah DMC.

A2.3 SUBCONTRACTORS

Several subcontractors provide the following support to the ESS:

- statistical support for evaluation of groundwater data for the quarterly landfill groundwater reports
- biological monitoring sampling (including deer, rabbit, and watershed monitoring sampling)

A3. PROBLEM DEFINITION/BACKGROUND

The Paducah Gaseous Diffusion Plant (PGDP) located in Paducah, Kentucky, is an operating uranium enrichment facility owned by the DOE. Effective July 1, 1993, DOE leased the plant production facilities at Paducah to the United States Enrichment Corporation (USEC) to provide operations and maintenance services. DOE contracted with BJC effective April 1, 1998, to manage and integrate the Environmental Management and Enrichment Facilities' activities for DOE.

During past operations of PGDP, hazardous substances generated as byproducts from the enrichment process were released into the environment. The source areas where releases originally occurred are often referred to as solid waste management units (SWMUs) and areas of concern (AOCs). In general, SWMUs and AOCs are typically areas such as burial grounds, spill sites, landfarms, surface impoundments, and underground storage tanks. The releases from these source areas can migrate into the surrounding soils, aquatic and terrestrial biota, and in some cases, the underlying groundwater and adjacent surface waters. In July 1988, groundwater samples collected from residential wells north of PGDP led to the discovery of trichloroethene or trichloroethylene (TCE) and technetium-99 (^{99}Tc) contamination in the regional gravel aquifer (RGA). With the participation of the Commonwealth of Kentucky, EPA, and DOE, the Administrative Consent Order (ACO) was entered effective November 23, 1988. The ACO was a legally binding agreement for the participating parties that initiated the investigation into the nature and extent of the contamination in these wells. On May 31, 1994, the PGDP was put on the National Priorities List (NPL) and a Federal Facilities Agreement (FFA) was negotiated among DOE, the Commonwealth of Kentucky, and EPA that became effective in February 1998. The ACO was superseded by the FFA. Additionally, a Resource Conservation and Recovery Act (RCRA) HSWA permit is held jointly between DOE and BJC with the Commonwealth of Kentucky. This permit defines actions consistent with the FFA for the investigation and remediation of the SWMUs and AOCs identified at Paducah. Investigations performed by the ACO/FFA revealed that environmental releases from certain SWMUs and AOCs have migrated to the groundwater and surface waters resulting in off-site contamination of the RGA.

A4. PROJECT/TASK DESCRIPTION

A4.1 PURPOSE

The purpose of this plan is to describe the practices used by the ESS and to ensure the quality of the data collection, analytical data generation, handling, and reporting of the environmental monitoring data. It is further intended to prevent significant quality failures prior to data generation and to minimize the impact of such failures. This plan also describes actions that are intended to ensure a high degree of confidence in the results of the environmental monitoring projects for the Kentucky Department for Environmental Protection (KDEP), EPA Region 4, and the public.

A4.2 SCOPE

The ESS performs effluent monitoring and environmental surveillance activities. Table A4-2 provides a listing of the different tasks under the ESS.

Effluent monitoring is initiated to achieve compliance with one or more federal or state regulations, permit conditions, or environmental commitments. This consists of KPDES monitoring of DOE Outfalls (analytical and aquatic environment toxicity testing); groundwater monitoring at permitted RCRA or solid waste landfill units, such as C-404, C-746-K, C-746-S, C-746-T, and C-746-U; and groundwater monitoring in response to administrative orders.

Table A4-2. Summary of ESS Activities.

Effluent Monitoring	Groundwater Surface Water—C-746-S & -T Landfill Runoff, KPDES Outfalls, and Watershed Monitoring (analytical and aquatic environment toxicity testing)
Environmental Surveillance	Groundwater Surface Water Sediment External Gamma Radiation Terrestrial Wildlife Aquatic Biological Monitoring

Environmental surveillance, which excludes the effluent monitoring previously described, is defined as perimeter and off-site monitoring. Environmental surveillance activities are performed to better understand the effects of DOE operations on the quality of the regional environment, to better address public concern about off-site contamination, and to meet DOE requirements. Environmental surveillance activities consist of groundwater surveillance monitoring wells, surface water and sediment sampling, external gamma radiation monitoring, terrestrial wildlife sampling, ecological monitoring, and bioaccumulation monitoring.

Other specific activities performed for both effluent monitoring and environmental surveillance include, but are not limited to, collection of groundwater, surface water, terrestrial wildlife, aquatic organisms, and sediment; storing, analyzing, and shipping samples; and data evaluation, verification, validation, assessment, and reporting.

Requirements and responsibilities described in this plan apply to all routine activities conducted by ESS personnel for effluent monitoring and environmental surveillance. Polychlorinated biphenyl (PCB) spills, asbestos events, and environmental spills are not within the scope of this QA/DM Plan.

A4.3 REQUIREMENTS

This QA/DM Plan is written to meet requirements identified in EPA QA/R-5, *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations*; SW-846, *Test Methods for Evaluating Solid Waste*; and DOE O 414.1, *Quality Assurance*. This document is supplemented by several CDM Federal procedures; and other contractors applicable plans and procedures (including a fixed-base laboratory QA plan).

A5. QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The ESS team conducted a Data Quality Objectives (DQOs) meeting to identify requirements for data collection. The DQOs and resulting sampling plans are outlined in the *Environmental Monitoring Plan,* BJC/PAD-121.

The QA objectives of the ESS are to generate quality assured data to ensure that data reported to EPA, KDEP, and the public is legally and scientifically defensible. The intended use of the acquired data is to provide regulatory reports and an annual site environmental report which discuss the solid and hazardous waste monitoring and the impact of PGDP operations on the environment. The primary users of the data are the ESS team members for decision making or for routine monitoring according to regulations or DOE Orders.

Analytical data consists primarily of definitive data (formerly QC Level III and formerly QC Level V) based on the data needs determined in the above-mentioned project-specific DQOs. Procedures used to assess precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS) parameters for data generated by ESS activities are discussed below.

A5.1 DATA QUALITY REQUIREMENTS AND PARCCS EVALUATION

This section defines the goals of PARCCS parameters for the data. Appropriate procedures and QC checks, as specified in the analytical method, are employed to assess the level of acceptance of these parameters. All sample results are reported for the data when the analytical sample set is completed. QC data generated are reported upon request. Acceptance criteria and evaluation of laboratory analytical results for the PARCCS parameters are determined according to the following outline and the appropriate analytical method.

Once generated data has been reviewed, verified, and/or validated, data assessment personnel will evaluate the finalized sample data assessment packages against the DQOs as discussed in Section A5. These DQOs include PARCCS parameters. The evaluation will serve as a check on whether the total measurement set had met the work assignment scope and objectives. The following text presents the methods used to evaluate the PARCCS DQOs.

A5.1.1 Accuracy, Precision, and Sensitivity of Analysis

The objective of the analytical QC requirements is to ensure adequate accuracy, precision and sensitivity of analysis. Samples collected for groundwater analysis during the project will be analyzed using EPA□s SW-846 analytical methods, *Test Methods for Evaluating Solid Waste,* for which QA/QC procedures have been established. Samples collected for KPDES will be analyzed using the EPA analytical methods, *Methods for Chemical Analysis of Water and Wastes.* Toxicity samples are analyzed in accordance with protocol published in *Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms,* EPA/600/4-89/001 (Second Edition). The precision and accuracy for each parameter/method is also provided in SW-846.

- **Accuracy**

Accuracy is defined as the nearness of a measurement to its true value. Accuracy measures the average or systematic error of a method. Accuracy of chemical test results is assessed by spiking samples with known standards and establishing the average recovery. For organic analyses, two type of recoveries are measured: matrix spike and surrogate spike. For a matrix spike, known amounts of standard compounds identical to the compounds present in the sample of interest are added to the sample. For a surrogate spike, the standards are chemically similar but not identical to the compounds being analyzed in the fraction. The purpose of the surrogate spike is to provide quality control on every sample by constantly monitoring for unusual matrix effects and gross sample processing errors. For inorganic analyses, only matrix spikes are measured in general. Since accuracy is often determined from spiked samples, laboratories commonly report accuracy in this form. Percent recovery is defined as:

$$\% \text{ Recovery} = \frac{R-U}{S} \times 100$$

where S = concentration of spike added
U = measured concentration in unspiked aliquot
R = measured concentration in spiked aliquot

- **Precision**

Precision is the agreement between a set of replicate or duplicate measurements without assumption of knowledge of the true value. Precision is assessed by means of duplicate/replicate sample analysis. Precision can usually be expressed as relative percent difference (RPD) or relative standard deviation (RSD). The quantities are defined as follows:

$$RPD = 100 \times 2 |X_1 - X_2| / (X_1 + X_2)$$

where X_1 and X_2 are the reported concentrations for each duplicate or replicate

$$RSD = \frac{S}{X} \times 100$$

where S is the standard deviation of the series of individual measurements and X is the mean of the series of individual measurements.

- **Sensitivity**

The sensitivity of analysis (or the detection limit) is determined by the SW-846 analytical method and the laboratory analyst and instrumentation. During the development of DQOs, the required detection limit is determined based on regulatory restrictions such as maximum contaminant levels (MCLs) for drinking water standards. The analytical laboratory is requested to meet these requirements.

A5.1.2 Field Representativeness, Completeness, and Comparability

The following discussion covers the DQOs of representativeness, completeness, and comparability and how these DQOs may be achievable through the field sampling operations and the analytical process.

- Representativeness

  Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. See Section A.7.1.2 regarding field procedures that contribute to representativeness of the sampled media. The documentation required in this QA/DM plan will enable checking that sampling protocols have been followed and sample identification and integrity have been assured. Field planning meetings, field assessments, and oversight by the Field Operations Leader will provide opportunities to check that field procedures are being correctly implemented.

  To ensure the representativeness of sampled media, demonstrated analyte-free water will be used in various field operations and during the preparation of trip blanks and field blanks. Samples will be maintained on ice upon sample collection and preserved for sample shipment in accordance with QA/DM plan requirements. Disposable gloves will be worn by field personnel and changed between sampling locations. The use of dedicated, decontaminated sampling equipment constructed with required material such as Teflon and stainless steel also contributes to the sample's representativeness.

  For the low-flow groundwater purging and sampling method, representativeness will be achieved by performing the sampling operation within the required criteria for water quality measurements, minimal drawdown, and low flow rate. The pump intake will be placed within the targeted horizon of the screened interval of the well. The water will be evacuated until water quality parameters have stabilized. Care will be taken to maintain sufficient pressure so as not to introduce air into the pump tubing. Samples will be collected with minimal turbulence directly from dedicated tubing constructed of appropriate material. The use of this sampling method should produce samples with less suspended solids than other groundwater sampling methods. Sampling methods and locations provide good representation of site characteristics.

- Completeness

  Completeness is defined as the percentage of all measurements made whose results are judged to be valid. Invalid data will be the data that have been rejected during data validation. It is expected that the laboratory will provide valid data meeting acceptance criteria for 90 percent of the samples analyzed. If the data provided is less than 90 percent complete, an evaluation will be made to determine whether additional samples should be collected.

  The completeness objective for this project is 90 percent.

  Percent of completeness is defined as:

$$\% \text{ Completeness} = \frac{V}{n} \times 100$$

  where V= number of measurements judged valid
  n = total number of measurements made

- Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Sample data will be comparable with other measurement data for similar samples and sample conditions. Use of consistent and standardized methods and units of measurement will maintain comparability of the data. Actual detection limits will depend on the sample matrix (necessary dilutions, etc.) and will be reported as defined for the specific samples.

A6. SPECIAL TRAINING REQUIREMENTS/CERTIFICATIONS

Personnel are trained in the safe and appropriate performance of their assigned duties in accordance with the requirements as outlined in the project training matrix. The training matrix is divided into training related to health and safety requirements identified in the BJC G-4 form, and project-specific or job-specific training, identified as required or beneficial to perform an assigned duty or function. Based upon assigned duties, the training matrix may include, but not be limited to, the following:

Health and Safety-Related Training

- Hazwoper training, such as 40-hour Occupational Safety and Health Administration (OSHA), 8-hour OSHA refresher, medical monitoring, and respirator training
- Plant-specific training, such as lockout-tagout, firewatch, etc.

Project-Specific or Job-Specific Training

- Project-specific documents, such as required reading on QA/DM plans, WM plans, H&S plans, operating procedures, and work instructions, etc.

Training files are maintained by the Training Coordinator. A training database is utilized to manage and track training. Personnel training records of CDM personnel only are maintained at the CDM Kevil office. Subcontractors maintain copies of training records at the appropriate satellite DMC.

A7. DOCUMENTATION AND RECORDS

A7.1 DOCUMENTS, PLANS, PROCEDURES, WORK INSTRUCTIONS, AND OPERATOR AIDS

The applicable and appropriate documents and procedures utilized for ESS activities are listed in Table A7-1. Documents, plans, procedures, work instructions, and operator aids utilized are identified in this section and may be referenced in the appropriate section discussing each project. Procedures are managed by the Procedures Coordinator.

Table A7-1. Documents, Plans, Procedures, Work Instructions, and Operator Aids.

Number	Title
	DOE/BJC Documents and Procedures
KY0004049	KPDES Permit
KY073-00014	C-746-S Residential Landfill Permit
KY073-00015	C-746-T Inert Landfill Permit
KY073-00045	C-746-U Residential Landfill Permit
KY8-890-008-982	Hazardous Solid Waste Amendments Permit
BJC/PAD-121	Environmental Monitoring Plan
DOE/OR/07-1707	Federal Facility Agreement for the Paducah Gaseous Diffusion Plant
	CDM Federal Paducah Environmental Management Program Procedures
CDM-001	Management and Use of Procedures, Work Instructions, and Operator Aids
CDM-002	Document Control
CDM-003	Records Management
CDM-004	Quality Assured Data
CDM-005	Logbooks
CDM-006	Sample Chain of Custody
CDM-007	Data Management Coordination
CDM-008	Sample Tracking and Handling Guidance
CDM-009	Collection of Field Quality Control Samples
CDM-010	Equipment Cleaning and Decontamination
CDM-011	Temporary Storage of Waste Materials
CDM-012	Groundwater Monitoring Sampling
CDM-013	Surface Water Monitoring Sampling
CDM-014	Water Level Measurements
CDM-015	Field Operation of the Hydrolab
CDM-016	Monthly Calibration of the Hydrolab
CDM-017	Temperature Control for Sample Storage
CDM-018	Maintenance and Use of the ASTM DI Water System
CDM-019	Composite Sampling
CDM-020	Surface Soil Sampling
CDM-021	Sediment Sampling
CDM-022	Deer Sampling
CDM-023	Hazard Review
CDM-024	Subsurface Soil Sampling
CDM-025	Volatile and Semivolatile Data Verification and Validation
CDM-026	Inorganic Data Verification and Validation
CDM-027	Pesticide and PCB Data Verification and Validation
CDM-028	Radiochemical Data Verification and Validation
CDM-029	Wet Chemistry Data Verification and Validation
CDM-030	Dixon and Furan Data Verification and Validation
CDM-031	Sampling Containerized Waste

A7.2 RECORDS MANAGEMENT

Records management is defined as the procedures and the process by which records will be maintained. The Records Coordinator will implement the records management requirements.

A7.2.1 Description of the Records Management System

The records management system is defined by CDM-003, *Records Management.* This procedure establishes the requirements to ensure consistent management of records maintained by the CDM Kevil DMC and its supporting satellite DMCs. The ESS records are maintained at three satellite DMCs; the record copy is located at CDM Kevil office, a working copy is located at BJC Kevil building, and records which are in-use are located at the field office (C-755-T-01 for GEO Consultants).

A7.2.2 Personnel Responsible for Records

The Project Manager has direct responsibility for ensuring the requirements are adhered to as stated in this plan. The Records Coordinator and Sampling Data Coordinator are responsible for the daily activities associated with records management and implementing the requirements stated in this plan.

A7.2.3 Identification of ESS Records

Information maintained at the satellite DMCs include, but are not limited to, documents, plans, procedures, logbooks, COC forms, personnel training records, and any field forms.

A listing of the records identified for submittal is in Exhibit I of the ESS. Other records (than those identified in Exhibit I) to be submitted are identified in Exhibit E, Section 3.1.3, of the ESS and are discussed in Table A7-2. These records include, but are not limited to, the following: training records, maintenance records, calibration records, assessment records, corrective action plans and evidence, procedures and work control documents, regulatory inspection records, field laboratory records, logbooks, waste inventory records, and chains of custody.

A7.2.4 Storage of ESS Records

ESS files are maintained at the satellite DMCs, are considered the project record copy, are stored in locked file cabinets and in duplicate in separate locations/buildings. The file cabinets will be labeled with the appropriate project identification and with a list of individuals authorized to access the project records. The removal of records from the files will be controlled by the use of withdrawal or "In/Out" cards. All electronic versions are also stored in the project file; the originator or the original recipient of the diskette maintains back-up copies.

Electronic backups of project data (which is stored in the ES PEMS) are made nightly by BJC Network Administrator and stored in the Paducah Project Document Control Center (PDCC).

A7.2.5 Transfer of Records to BJC

Documents, plans, procedures, and records to be submitted are provided in Exhibit I of the ESS subcontract. Upon completion, these records are submitted to BJC with a cover letter to the attention of BJC STR. The STR is then responsible for distributing to the Paducah PDCC and to the appropriate

Table A7-2. Transfer of Records to BJC.

Record Type	Storage Location	Frequency of Transfer	Comments
Training records	CDM Kevil	Upon request	Submittal letter with a copy of training records will be submitted to BJC STR.
Maintenance records	C-755-T-01	Upon request	Submittal letter with a copy of maintenance records will be submitted to BJC STR.
Calibration records	C-755-T-01	Upon request	Submittal letter with a copy of calibration records will be submitted to BJC STR.
Assessment records (i.e., audits, surveillances, and self assessment reports)	CDM Kevil	Upon request	Submittal letter with a copy of assessment records will be submitted to BJC STR.
Corrective action plans and evidence	CDM Kevil	As needed	Submittal letter with a copy of corrective action records will be submitted to the BJC STR or the Corrective Action Manager.
Procedures and work control documents	CDM Kevil	Periodically	Procedures, work instructions and operator aids were initially submitted as required; changes will be submitted, as necessary, to BJC STR.
Regulatory inspection records	CDM Kevil	Upon request	Submittal letter with a copy of regulatory inspection records will be submitted to BJC STR.
Logbooks	C-755-T-01	Project completion	Submittal letter with the original logbooks will be submitted to BJC STR.
Waste inventory records	C-755-T-01	Project completion	Submittal letter with a copy of the waste inventory records will be submitted to BJC STR.
Chains of custody	C-755-T-01	Periodically	Submittal letter with a copy will be submitted to BJC Sample Manager; the letter without an attachment will go to BJC STR.

personnel within BJC. Electronic copies of the submittal records are provided to BJC STR when required by Exhibit I of the ESS subcontract.

The suggested records listing in Exhibit E are transferred according to the frequency identified in Table A7-2. On the specified frequency, these records are submitted to BJC with a cover letter to the attention of the BJC STR. The STR is then responsible for distributing these records to the Paducah PDCC and to the appropriate personnel within BJC.

A7.2.6 Retention of Records

Quality records will be maintained in CDM Federal files for duration of the project. Upon submittal of records to the BJC STR, the record will be identified as a quality record or otherwise. At that time, the Paducah PDCC will determine the time frame for the retention of the record.

B. SAMPLE PLANNING, MANAGEMENT, AND MEASUREMENT/DATA ACQUISITION

The ESS collects many types of data to measure and monitor effluents from DOE operations and to maintain surveillance on the effects of those operations on the environment and public health. Data types collected for ESS are described in the following sections and consist of sample information, field measurements, and definitive data. Data are collected in accordance with requirements in CDM-004, *Quality Assured Data*.

B1. DATA COLLECTION DESIGN

The *Environmental Monitoring Plan*, BJC/PAD-121, provides detailed information on sampling locations, the types of samples and sample parameters required at each location, and the frequency of collection for ESS samples.

B1.1 SAMPLE INFORMATION

Sample information is environmental data describing the sampling event and consists of the following: station (or location), date collected, time collected, and other sampling conditions collected for every sampling event. This information is recorded in logbooks and may be included on the COC or sample labels. This information is input directly into ES PEMS on a weekly basis, as applicable.

B1.2 FIELD MEASUREMENTS

Field measurements are measurements of a parameter without physical collection of a sample which are collected real-time in the field. Field measurements for the ESS include water level measurements, pH, conductivity, flow rates, temperature, barometric pressure, residual chlorine, and dissolved oxygen. Field measurements for the biological monitoring program include stream depth, stream width, and turbidity. All fish collected for the fish community task are counted and identified. Most fish are also weighed and measured in the field. Environmental conditions such as temperature and weather may also be recorded.

Field measurements are taken and downloaded electronically or recorded on appropriate field forms or in logbooks and input into ES PEMS. If field forms are used, they are input and QC checked against the field logbook. Criteria for field measurements are provided in Table B1-2.

Table B1-2. Field Measurement Criteria.

Sampling Activity	Field Screening Method	Criteria for Sample Selection
Low-Flow/ Minimal Drawdown Groundwater Sampling	Field measurements for pH, specific conductivity, temperature, dissolved oxygen (DO).	• pH must read within the ±0.1 range; • temperature must read within ± 1C; • conductivity must read ± 20 µmhos/cm; • dissolved oxygen must read within ± 0.5 mg/L
Surface Water Sampling	Field measurements for pH, specific conductivity, temperature, dissolved oxygen , total residual chlorine, and flow rate.	• pH must read within the ±0.1 range; • temperature must read within ± 1C; • conductivity must read ± 20 µmhos/cm; • dissolved oxygen must read within ± 0.5 mg/L

B1.3 DEFINITIVE DATA

Definitive data is defined as the analytical and biological monitoring data generated by the fixed-base laboratory. Analyses are specified in Appendix C of BJC/PAD-121, *Environmental Monitoring Plan*. Definitive data generated by the fixed-base laboratory is required to undergo a laboratory data review for consistency and completeness in accordance with the fixed-base laboratory QA plan. The primary data outputs include data packages (i.e., hard copies) and EDDs.

All data packages received from the fixed-base laboratory are tracked, reviewed, and maintained in a secure environment. The primary individual responsible for these tasks is the BJC Sample Manager. CDM-007, *Data Management Coordination*, provides the process of evaluating the quality of laboratory EDDs.

Definitive data for the biological monitoring program is fish community data (fish identification, number of fish, length, and weight) and fish contaminant data.

B2. SAMPLING METHODS REQUIREMENTS

B2.1 SAMPLE PLANNING AND MANAGEMENT

The DQOs discussed in Section A5 and in the *Environmental Monitoring Plan* are used to create Statements of Work (SOWs) for sampling and analyses to be performed. This information is input into ES PEMS for the purpose of sample planning, scheduling, and management. ES PEMS is used to plan sampling and manage data. ES PEMS performs the following functions:

- Produce COC records and sample labels.
- Track sample collection and shipment.
- Manage field-generated data.
- Import laboratory-generated data.

- Update field and laboratory data based on integrated data verification and validation.
- Report data for project use.
- Format data for transfer data to Paducah OREIS.

Requirements for addressing the day-to-day operations of ES PEMS include data entry, backups, security, and interface with the BJC Sample Manager and BJC Data Manager. A QC check of the sample information and measurements data entry is made and involves comparing printouts of 100 percent of the data in ES PEMS to the original COC, field form, logbook, or instrument printout. Guidelines set forth in CDM-007, *Data Management Coordination*, are followed. The QC check should be appropriately documented.

System backups are performed daily by the BJC Network Administrator. Backups follow normal protocol maintained by the BJC Network Administrator. Upon completion of the ESS, ES PEMS will be downloaded to an ASCII file, stored on a zip disk or other form of electronic media, and transferred to the PDCC for archival. PEMS-001, *Archiving Data for PEMS*, discuss the process for archival. Security of the data within ES PEMS is essential for the success of the ESS. The security precautions and procedures implemented by the data management team are designed to minimize the vulnerability of the data to unauthorized access or corruption. ES PEMS users have BJC network passwords and have installed password-protected screen savers.

B3. SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Samples are uniquely identified by a sample identification number. Sample identification numbers for the ESS are identified in ES PEMS and are assigned by the Data Coordinator or Sampling Data Coordinator according to the project, sample type, and location. An example of the sample numbering schemes used for the ESS is provided below for each different type of media.

Groundwater Sampling Identification Numbers. For groundwater sampling, the sample identification numbering system is used for all groundwater, carbon-filtered, and quality control samples, such as duplicates, field blanks, trip blanks, and equipment rinseates (blanks) in the following format:

MW###LE-YY, where
MW### is the sequential number of the monitoring well
L is the location number such as C404 (for C404), KG (for C-746-K), SG (for C-746-S and -T), or UG (for C-746-U);
E is the number of the event of when the samples were collected;
YY is the year the sample was collected.

For example, "MW226C4041-01" is a sample identification number where a groundwater samples was collected at "MW226," a monitoring well at a specific location near the "C404" Landfill, during the first event in 2001. A field duplicate sample is identified by the addition of a "D" after the "MW###" in the numbering scheme. For example, "MW226DC4041-01" is the duplicate sample of "MW226C4041-01." Adding a "TB" (for a trip blank), a "FB" (for a field blank), or a "RI" (for an equipment rinseate) to the front of the numbering scheme identifies the trip blanks, field blanks, and equipment rinseates. For example, "TBC4041-01" is a trip blank ("TB") that was collected at C-404 during the first groundwater sampling event of the fiscal year 2001.

Surface Water Sampling Identification Numbers. For surface water sampling associated with effluent monitoring at the landfills, a sample identification numbering system is made of a series of numbers in the following format:

LXE-YY, where	L is the L series location number such as L1, L10, L29, L64, etc.; X is the location/description such as SS (for C-746-S surface water) and US (for C-746-U surface water); E is the number of the event of when the samples were collected; YY is the year the sample was collected.

For example, "L135SS1-01" is a sample identification number where "L135" denotes the sample was taken at a specified location; "SS" denotes surface water samples were collected at C-746-S; "1" denotes the sample was collected in the first event for the fiscal year, and "01" denotes the year, 2001, in which the sample was taken. A field duplicate sample is identified by the addition of a "D" after the "L" in the numbering scheme. For example, "L135DSS1-01" is a duplicate surface water sample collected at location L135 at C-746-S during the first event of fiscal year 2001. Adding a "TB" (for a trip blank), a "FB" (for a field blank), or a "RI" (for an equipment rinseate) to the front of the numbering scheme identifies the trip blanks, field blanks, and equipment rinseates. For example, "TBL135SS1-01" is a trip blank ("TB") that was collected at location L135 at C-746-S during the first surface water sampling event of the fiscal year 2001.

For surface water sampling associated with surveillance monitoring, a sample identification numbering system is made of a series of numbers in the following format:

LEMPN-YY, where	L is the L series location number such as L1, L10, L29, L64, etc.; EMP denotes the samples were collected for the ESS; N is the month in which the samples were collected; YY is the year the sample was collected.

For example, "L29EMP4-01" is a sample identification number where "L29" denotes the sample was taken at a specified location; "EMP" denotes the samples were collected for the ESS; "4" denotes the sample was collected in the fourth month, April, and "01" denotes the year, 2001, in which the sample was taken. A field duplicate sample is identified by the addition of a "D" after the "L" in the numbering scheme. For example, "L10DEMP4-99" is a duplicate sample collected at location L10 for the ESS during April 2001. Adding a "TB" (for a trip blank), a "FB" (for a field blank), or a "RI" (for an equipment rinseate) to the front of the numbering scheme identifies the trip blanks, field blanks, and equipment rinseates. For example, "TBL1EMP8-01" is a trip blank ("TB") that was collected at location L1 for the ESS during August 2001.

Sediment Sampling Identification Numbers. For sediment sampling, a sample identification numbering system is made of a series of numbers in the following format:

SEMPSDN-YY, where	S is the S series location number such as S1, S20, S21, S27, etc.; EMPSD denotes the samples were collected for the ESS sediment sampling program; N is the month in which the samples were collected; YY is the year the sample was collected.

For example, "S27EMPSD6-01" is a sample identification number where "S27" denotes the sample was collected at a specified location; "EMPSD" denotes the samples were collected for the ESS sediment sampling program; N denotes the sample was collected in the sixth month, June, and "01" denotes the year, 2001, in which the sample was collected. A field duplicate sample is identified by the addition of a "D" after the "S" in the numbering scheme. For example, "S1DEMPSD6-01" is a duplicate sample collected at location S1 for the ESS sediment sampling program during June 2001. Adding a "TB" (for a trip blank), a "FB" (for a field

blank), or a "RI" (for an equipment rinseate) to the front of the numbering scheme identifies the trip blanks, field blanks, and equipment rinseates.

KPDES Sampling Identification Numbers. For KPDES sampling, a sample identification numbering system is made of several different series of numbers in the following formats:

TLN-YY, where
T is the timeframe of collection such as a weekly (W1, W2, W3, or W4), a monthly sample (M), or a quarterly sample (Q);
L is the outfall location such as K001, K015, K017, or K019;
N is the month in which the sample was collected;
YY is the year the sample was collected.

For example, "MK0174-01" is a sample identification number where "M" denotes a monthly sample was collected at outfall K017; "4" denotes the sample was collected in the fourth month, April, and "01" denotes the year, 2001, in which the sample was collected. A field duplicate sample is identified by the addition of a "D" after the "T" in the numbering scheme. For example, "MDK0157-01" is a duplicate sample collected at outfall K015 during July 2001. Adding a "TB" (for a trip blank), a "FB" (for a field blank), or a "RI" (for an equipment rinseate) to the front of the numbering scheme identifies the trip blanks, field blanks, and equipment rinseates. For example, "FBMK0018-01" is a field blank ("FB") that was collected at outfall K001 during August 2001.

Two exceptions exist for the KPDES sample identification numbering scheme described above. The first is for samples collected for radionuclide analyses. The second is for quarterly toxicity samples. The numbering schemes are identified as follows:

1.) For KPDES samples that are analyzed for radionuclides, the following format is used:

TRLN-YY, where
T is the timeframe of collection such as a weekly (W1, W2, W3, or W4), a monthly sample (M), or a quarterly sample (Q);
R identifies this sample as one to be analyzed for radionuclides;
L is the outfall location such as K001, K015, K017, or K019;
N is the month in which the sample was collected;
YY is the year the sample was collected.

For example, "QRK0014-01" is a quarterly sample collected at outfall K001 on April 2001 for radiochemical analyses.

2.) For KPDES quarterly toxicity samples, the following format is used:

QZTXLN-YY, where
Q is the timeframe of collection—in this case quarterly;
Z is the sequential sample collected for the toxicity sample, such as 1, 2, 3, and 4;
TX identifies this sample as one to be analyzed for toxicity;
L is the outfall location such as K001, K015, K017, or K019;
N is the month in which the sample was collected;
YY is the year the sample was collected.

For example, "Q2TXK0017-01" is the second quarterly toxicity sample that was collected at Outfall K001during July 2001.

Terrestrial Biota Sampling Identification Numbers. For deer sampling, the sample identification number is made up of a series of numbers in the following format:

BNNEMPYY-T, where
B is the terrestrial biota which was sampled, such as deer (D), rabbit (RB), or raccoon (R);
NN is the sequential number of the order in which terrestrial biota were collected, noting that a number with one digit is denoted for that digit only (e.g., the first deer collected is denoted by "D1");
EMP denotes the samples were collected for the ESS;
YY is the year the terrestrial biota were collected; and
T is the type of tissue matrix collected, such as bone (B), muscle (M), fat (F), liver (L), or thyroid (T).

For example, "D10EMP01-B" denotes that a bone ("B") sample was collected from the tenth deer ("D10") sampled in 2001 ("01") for the ESS ("EMP"). A duplicate sample is denoted by the words "DUP" appearing after the "BNN" sequence of numbers described above. For example, "D1DUPEMP01-T" denotes that a duplicate sample of the thyroid was collected from the first deer sampled in 2001 for the ESS. Equipment rinseates are identified by the addition of "RI1", "RI2", and "RI3" at the end of the numbering scheme "DEMP01."

Sample Handling Procedures and Documentation. The samples are properly preserved, packaged, and delivered to the laboratory under proper COC. The following procedures are used for handling samples:

- CDM-004, *Quality Assured Data*
- CDM-005, *Logbooks*
- CDM-006, *Sample Chain of Custody*
- CDM-007, *Data Management Coordination*
- CDM-008, *Sample Tracking and Handling Guidance*
- CDM-009, *Collection of Field Quality Control Samples*
- CDM-010, *Equipment Cleaning and Decontamination*

Documentation from the sample collection process is in the form of logbooks, COC forms, and other records. Prior to the shipment of samples to fixed-base laboratories, a copy of the COC is to be provided to the BJC Sample Manager. The BJC Sample Management Organization (SMO) coordinates the shipment of samples to a fixed-base laboratory.

B4. ANALYTICAL METHOD REQUIREMENTS

When available and appropriate for the sample matrix, SW-846 methods or EPA methods are used. When not available, other nationally recognized methods such as those of DOE, EPA, and the American Society for Testing and Materials will be used. Analytical methods are specified in Appendix C of BJC/PAD-121, *Environmental Monitoring Plan*. Analytical methods, sample preservation, holding times, and container requirements and analytical parameters are also identified in the analytical SOWs in ES PEMS.

B5. QUALITY CONTROL REQUIREMENTS

B5.1 FIELD QUALITY CONTROL SAMPLES

Table B5-1 provides a summary of the field QC samples that are taken for the ESS. Field QC samples include filter blanks, field blanks, equipment blanks, field duplicates, and trip blanks. QC samples for ESS activities are collected 1 per every 20 samples, as defined by SW-846, *Test Methods for Evaluating Solid Waste*. These samples will be analyzed in the same manner as the field samples.

- Field Duplicates (or Replicates)

  Field duplicate samples are collected and analyzed to assess the overall precision of the field and laboratory effort. Field duplicate samples, of a similar matrix, will be collected at a rate of five percent or one per 20 samples or less.

- Trip Blanks

  Trip blanks are used to determine whether on-site atmospheric contaminants are seeping into the sample vials, or if any cross-contamination of samples is occurring during shipment or storage of sample containers. A trip blank consists of demonstrated analyte-free water (based on target compound list [TCL] analysis results falling below Contract Required Quantitation Limits) sealed in 40-mL Teflon septum vials with no headspace (including bubbles) in the vials. Trip blanks are to be kept in close proximity to the samples being collected and will be maintained at 4° C and handled in the same manner as the other volatile organic compounds (VOCs) aqueous samples. Trip blanks are collected at a frequency of one per 20 environmental samples or one per day, whichever is more frequent. Trip blanks will be analyzed for volatile organics only.

- Field Blanks

  A field blank is a sample that serves as a check on environmental contamination at the sample site. Distilled, analyte-free water is transported to the site, opened in the field, transferred into each type of sample bottle, and returned to the laboratory for analysis of all parameters associated with that sampling event. It is also acceptable for field blanks to be filled in the lab, transported to the field, and then opened. Field blanks may be used as a reagent blank, as needed. One field blank will be collected per every 20 environmental samples.

- Equipment Blanks (or Rinseates)

  An equipment blank is a sample of analyte-free water passed through decontaminated sampling equipment. Equipment blanks are used as a measure of decontamination process effectiveness and are analyzed for the same parameters as the sample collected with the equipment. Equipment blanks may also be used as a reagent blank, as needed. Equipment blanks are required only when nondisposable, non-dedicated equipment is being used. Equipment blanks are collected at a frequency of one per 20 environmental samples.

Table B5-1. ESS Field QC Samples

QC Samples	Frequency
Field Duplicates	One per 20 samples
Trip Blanks*	One per 20 samples to be analyzed for VOCs or one per day, whichever is more frequent
Field Blanks	One per 20 samples
Equipment Blanks	One per 20 samples
Filter Blanks**	One per lot number

* Supporting this different approach i.e. different than one VOA per cooler, is the fact that no detectable result of VOAs have been seen in the trip blanks during routine environmental monitoring sampling.

** Filter blanks are anticipated to be collected less than six times per year as an additional QC measurement.

B5.2 INTERNAL QC CHECKS AND FREQUENCY FOR LABORATORY ANALYSIS

The fixed-base laboratory has an established internal QC program that is managed by the laboratory supervisors. QC samples are run in accordance with the applicable regulatory procedure or method. Where regulatory methods do not apply, QC is defined in the technical procedure.

B5.2.1 Independent Quality Control

The fixed-base laboratories are directed by DOE and EPA regulators to participate in independent QC programs, such as Proficiency Evaluation Testing and Proficiency Acceptance Testing, etc. The site fixed-base laboratory participates in additional voluntary independent programs to improve analytical QC. These programs generate data that are readily recognizable as objective measures, allowing the participating laboratory and government agencies a periodic review of their performance. Results that exceed acceptable limits are investigated and documented according to formal procedures. Although participation in a certain program is mandated, the degree of participation is voluntary so that each laboratory can select parameters of particular interest to that facility. These programs are conducted by EPA, DOE, and commercial laboratories.

The EPA has an additional quality assurance program known as the Discharge Monitoring Report – Quality Assurance (DMR-QA) study. This study applies to all major and selected minor permittees under the National Pollutant Discharge Elimination System (NPDES). The purpose is to evaluate the analytical and reporting ability of the laboratories routinely performing the inorganic chemical and whole-effluent toxicity self-monitoring analyses required in NPDES permits. These results are periodically reported in the DMR.

B6. INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

Any equipment (an inclusive term for tools, gauges, instruments, and other items that have specific preventive maintenance) is serviced as specified by manufacturers recommended schedule or performed according to the procedures defined in Section A9.1. Maintenance activities are documented in the appropriate logbook. Out-of-service equipment is clearly tagged. Changing or removing status indicators is the responsibility of the ESS Operations Managers or designee. Spare parts are maintained for equipment as needed.

The laboratories are also responsible for implementing preventive maintenance procedures, schedules, and record keeping similar to those described previously for field equipment on instruments and equipment. For additional information, refer to the fixed-base laboratory QA Plan.

B7. INSTRUMENT CALIBRATION AND FREQUENCY

B7.1 FIELD EQUIPMENT CALIBRATION PROCEDURES AND FREQUENCIES

Calibration of equipment is performed according to the procedures defined in Section A9 or in accordance with manufacturer specifications. Calibrations that are performed more frequently than once each month are tracked and documented by the instrument user as delineated in the individual calibration procedure. For the ES project, calibration schedules are also tracked by the Preventive Maintenance Computer System. Table B7-1 provides a listing of the Field Measurement Equipment that is calibrated. Documentation of calibration and maintenance activities is in the form of logbook entries and are reviewed and approved by the Field Operations Manager or designee.

Table B7-1. Field Measurement Equipment.

Instrument	Reference	Calibrated Instrument Range
Hydrolab Water Quality Meter (measures pH, conductivity, turbidity, dissolved oxygen, and temperature)	CDM-015, *Field Operation of Hydrolab* CDM-016, *Monthly Calibration of Hydrolab*	• pH must read within the ±0.1 range; • temperature must read within ± 1C; • conductivity must read ± 20 µmhos/cm; • dissolved oxygen must read within ± 0.5 mg/L
Hach Portable Colorimeter (measures total residual chlorine)	Manufacturer's Specifications	Colorimeter was factory calibrated; no true calibration is performed; however an accuracy check is performed using a known source.

B7.2 LABORATORY EQUIPMENT CALIBRATION PROCEDURES AND FREQUENCIES

Analytical equipment utilized by the fixed-base laboratory is controlled according to procedures approved by the SMO. Calibration procedures used by approved off-site laboratories are documented in the laboratory QA plan.

B8. INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES (PROCUREMENT)

Inspection/acceptance requirements for supplies and consumables are managed in accordance with the CDM Federal QA and procurement procedures.

B9. DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENT)

All historical data used in support of ESS is downloaded or directly accessed from Paducah OREIS, if available. If historical data required for ESS is not available from Paducah OREIS, other databases, records, etc., may be used with the approval of the BJC Data Manager.

B10. DATA MANAGEMENT

ESS utilizes ES PEMS for sample scheduling, collection, and tracking each sample and associated data from point of collection through final data reporting. ES PEMS tracking includes field forms, COCs, hard copy data packages, and EDDs. Data is entered as the project progresses. All field measurement data, analytical data, sampling information, and other pertinent information are entered into ES PEMS.

Field measurement data and sampling information is entered into ES PEMS on a routine basis. Analytical EDDs are loaded to ES PEMS as they are provided by BJC Sample and Data Management. Project data sets are verified, validated (if applicable) and assessed. Once the assessment is complete, an ASCII file is prepared with the project data and associated QC samples and transmitted to the BJC Data Manager for inclusion into Paducah OREIS and for official reporting.

C. ASSESSMENT/OVERSIGHT

C1. ASSESSMENTS AND RESPONSE ACTIONS

Audits are performed to review and evaluate adherence to requirements. Unscheduled and scheduled audits may be performed to verify compliance with all aspects of the QA Program and determine the program's effectiveness. These audits are conducted in accordance with written procedures and checklists and are performed by personnel who do not have direct responsibility for performing the activities being audited.

Surveillance activities include reviewing documents and monitoring work activities to provide an effective real-time means of evaluating the adequacy and effectiveness of methods for achieving quality.

Corrective actions of internal audit/surveillance findings and nonconformances are managed in accordance with the CDM Federal Programs Corporation Quality Assurance Manual.

C2. REPORTS TO MANAGEMENT

Reports providing a status update on the activities affecting quality are provided to management upon request.

D. DATA VALIDATION AND USABILITY

D1. DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

The data review process determines whether a set of environmental data satisfies the data requirements defined during DQOs. This process involves the integration and evaluation of all information associated with a result. Data review consists of an evaluation of the following: data authenticity, data integrity, data usability, and outliers. An explanation of the data review process is provided in the following sections and a summary of data reviews is shown in Table D1-1.

The data review process is conducted using the Data Quality Checks checklists from CDM-004. This checklist provides a listing of the QC elements that may be applicable to each groundwater and EM program. Checklists are completed as required for reporting.

D1.1 INITIAL DATA REVIEWS

Initial data reviews are conducted by an Environmental Compliance Technical Representative, or a designee, prior to submitting documents, plans, data, etc., to the BJC STR for review and approval. Sampling information and field measurements data is routinely reviewed and approved by the Field Operations Manager.

D1.2 FINAL DATA REVIEW AND DATA USAGE

Final data reviews are reviews performed prior to release of data to external agencies to ensure accuracy in reported results. The final data review steps are performed by the Project Manager, Environmental Compliance Technical Representative, Data Coordinator, Quality Coordinator, and other ESS team members as appropriate.

D1.2.1 Laboratory Contractual Screening

Laboratory contractual screening is the process of evaluating a set of data against the requirements specified in the analytical SOW to ensure that all requested information is received. The contractual screening includes, but is not limited to, the COC, number of samples, analytes requested, total number of analyses, method used, QC samples analyzed, EDDs, units, holding times, and reporting limits achieved. The BJC Sample Manager is primarily responsible for the contractual screening upon receipt of data from the analytical laboratory.

Table D1-1. Data Types, Reviews, and Frequencies[a]

Data Type	Data Review[b]				
Media	Initial Data Review	Contractual Screening	Verification	Validation	Assessment
EFFLUENT MONITORING					
Groundwater (MW Sampling at C-404, C-746-S, C-746-T, C-746-U, C-746-K, NE Plume, NW Plume, MW66, and Residential)					
Sample Information					
Field Measurements*	Monthly	Quarterly**	Quarterly**	Quarterly**	Quarterly**
Definitive Data	Monthly	Quarterly**	Quarterly**	Quarterly**	Quarterly**
Surface Water (KPDES Sampling at 4 KPDES Outfalls, Surface Water Sampling at C-746-S, C-746-T, and C-746-U)					
Sample Information					
Field Measurements*	Weekly	Monthly***	Monthly***	N/A	Monthly***
Definitive Data	Weekly	Monthly***	Monthly***	See Attachment 2	Monthly***
Watershed Monitoring (Macroinvertebrates, Bioaccumulation, and Fish Population Sampling)					
Sample Information					
Field Measurements*	Annually	N/A	Annually	N/A	Annually
Definitive Data	Annually	N/A	Annually	N/A	Annually
ENVIRONMENTAL SURVEILLANCE					
Groundwater (Env. Surv.-S, Q, RAD)					
Sample Information					
Field Measurements*	Semiannually	Semiannually	S, A	N/A	S, A
Definitive Data	Semiannually	Semiannually	S, A	See Attachment 2	S, A
Surface Water (Locations on BBC, LBC, and Massac Creek)					
Sample Information					
Field Measurements*	Quarterly	Quarterly	Quarterly	N/A	Quarterly
Definitive Data	Quarterly	Quarterly	Quarterly	See Attachment 2	Quarterly
Sediment (Locations along BBC, LBC, and Massac Creek)					
Sample Information					
Field Measurements*	Semiannually	Semiannually	Semiannually	N/A	Semiannually
Definitive Data	Semiannually	Semiannually	Semiannually	See Attachment 2	Semiannually
External Gamma Radiation (46 TLDs on DOE property and surrounding area)					
Sample Information					
Field Measurements*	Quarterly	N/A	Annually	N/A	Annually
Definitive Data	Quarterly	N/A	Annually	N/A	Annually
Terrestrial Environment (Annual Deer Sampling)					
Sample Information					
Field Measurements*	Annually	Annually	Annually	N/A	Annually
Definitive Data	Annually	Annually	Annually	See Attachment 2	Annually
Aquatic Biological Monitoring (Fish Community, Forage Fish)					
Sample Information					
Field Measurements*	Annually	N/A	Annually	N/A	Annually
Definitive Data	Annually	N/A	Annually	N/A	Annually

a Parameters and additional locations are identified in the EMP (BJC/PAD-285 or latest revision).
b Data review, by means of project surveillance, walkthroughs, self assessments, and audits, is not included in this table.
* Field Measurements consist of parameters identified in Section B7.1.
** Verification, validation, and assessment performed semiannually for monitoring wells located at C-404, and Semiannual Residential MWs, and Annual Radiological parameters.
*** Surface Water Sampling at C-746-S, C-746-T, and C-746-U is performed on a quarterly basis.
M=Monthly; Q=Quarterly; S=Semiannually; A=Annually; Frequencies for each location discuss varies. Refer to the EMP (BJC/PAD-121 or latest revision) for additional information.

D1.2.2 Data Verification

Data verification is the process for comparing a data set against a set standard or contractual requirement. Verification is performed by the Data Coordinator electronically, manually, or by a combination of both. Data verification may include contractual screening and also criteria specific to the ESS. Data is flagged as necessary. Verification qualifiers are stored in ES PEMS and transferred with the data to Paducah OREIS.

D1.2.3 Data Validation

Data validation is the process performed by a qualified individual for a data set, independent from sampling, laboratory, project management, or other decision-making personnel for the ESS. Data validation evaluates the laboratory adherence to analytical-method requirements. Data validation is managed according to a task-specific operator aid and coordinated with the Data Validator by the QA Coordinator. The Data Validator perform data validation according to the procedures identified in Section D2. Validation qualifiers are input and stored in ES PEMS and transferred to Paducah OREIS.

Definitive data is validated at a minimum of five percent of the total data packages from routine sampling events and is applied programmatically for each type of media. Data packages chosen for validation are validated at 100 percent. Attachment 2 provides the validation strategy, which outlines data packages to be validated for environmental sampling activities.

D1.2.4 Data Assessment

Data assessment is the process for assuring that the type, quality, and quantity of data are appropriate for their intended use. It allows for the determination that a decision (or estimate) can be made with the desired level of confidence, given the quality of the data set. Data assessment follows data verification and data validation (if applicable) and must be performed at a rate of 100 percent to ensure data is useable.

The data assessment is conducted by a technical reviewer or their designee in conjunction with other project team members according to CDM-004. Assessment qualifiers are stored in ES PEMS and transferred with the data to Paducah OREIS. Data is made available for reporting upon completion of the data assessment, and associated documentation (Data Assessment Review Checklist) is filed with the project files. Any problems found during the review process are resolved and documented in the data assessment package.

D1.2.5 Data Consolidation and Usage

The data consolidation process consists of the activities necessary to prepare the evaluated data for the users. The Data Coordinator prepares files of the assessed data from the ES PEMS to Paducah OREIS for future use. The BJC Data Manager is responsible for transferring the data to Paducah OREIS. Data used in reports (e.g., the Quarterly Landfill Reports, the Annual Site Environmental Report, and the Report on Biological Monitoring Program) distributed to external agencies is obtained from data in Paducah OREIS and has been through the data review process. Data used for the Discharge Monitoring Report has been through the data review process, but due to the quick turnaround time, may not be loaded to Paducah OREIS at the time of reporting. All data reported has the approval of the BJC Data Manager.

D2. VALIDATION AND VERIFICATION METHODS

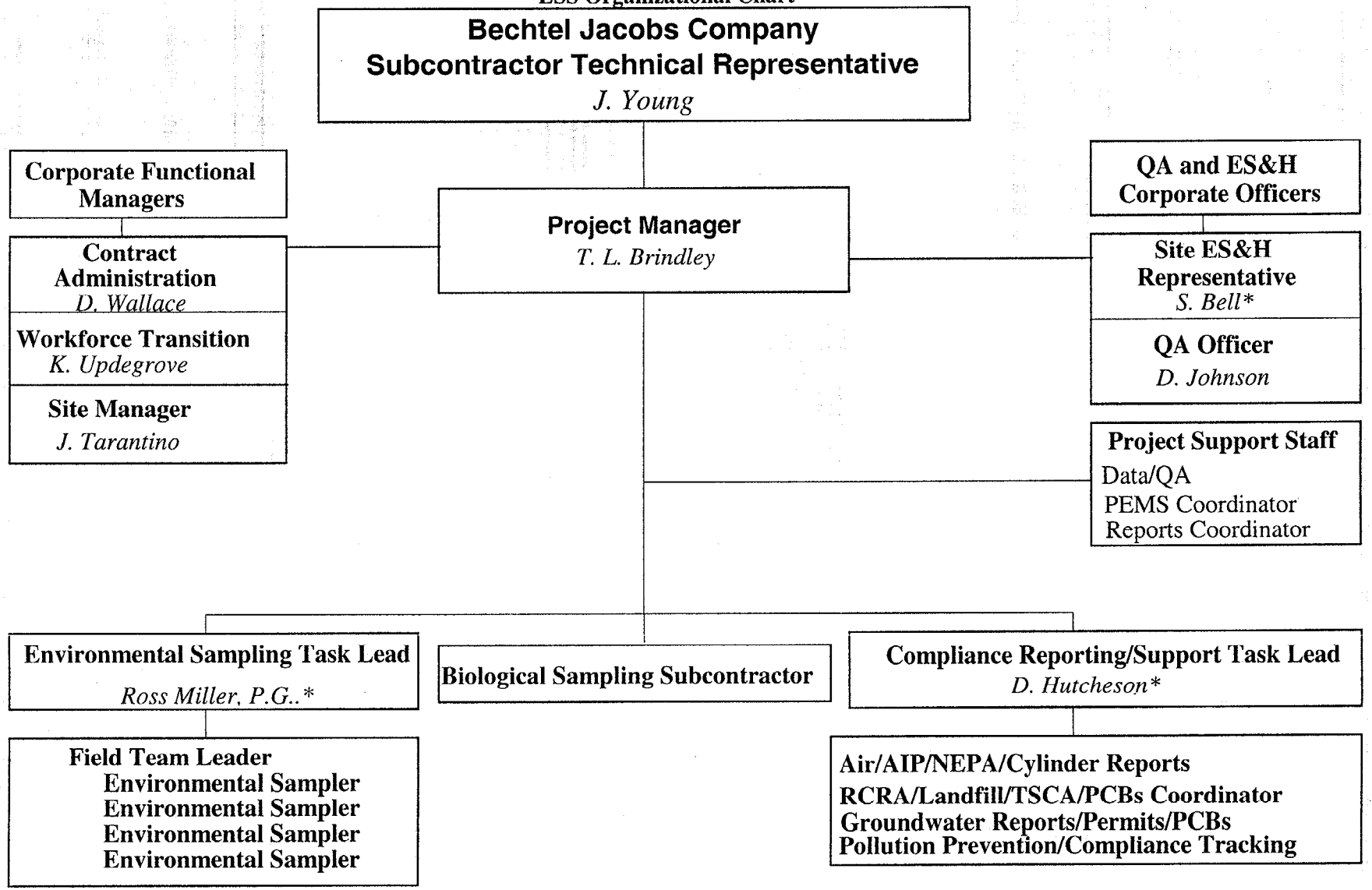
Data verification and validation is performed according to CDM-004 and the following Paducah CDM Federal procedures:

- CDM-025, *Volatile and Semivolatile Data Verification and Validation*
- CDM-026, *Inorganic Data Verification and Validation*
- CDM-027, *Pesticide and PCB Data Verification and Validation*
- CDM-028, *Radiochemical Data Verification and Validation*
- CDM-029, *Wet Chemistry Data Verification and Validation*
- CDM-030, *Dixon and Furan Data Verification and Validation*

D3. RECONCILIATION WITH USER REQUIREMENTS

The equations used for precision, accuracy, and completeness will be used to quantitatively compare sample data results with the required DQOs. Any DQO deviations and/or data outliers will be discussed with the appropriate personnel to determine possible causes for such conditions. Discussions, evaluations, and conclusions as a result of the above assessments will be consolidated into the data assessment report. The assessment qualifiers and supporting comments will note any limitations on the use of the data.

ATTACHMENT 1
ESS Organizational Chart



Home Office Personnel			
Administrators	220	Geologists	
Civil Engineers		Hydrogeologists	38
Computer/Data Managers	88	Hydrologists	36
Drafters/Designers/CADD	157	Industrial Hygiene/	21
Environmental Engineers	126	Health Specialists	
Environmental Scientists	87	Technicians	129

* Key personnel

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ATTACHMENT 2
ESS Data Validation Strategy

Data Validation Strategy for the Environmental Services Subcontract (ESS)

MEDIA—GROUNDWATER

Sampling Location	Analytical Parameters	Analytical Methods	Analytical Laboratory	Sample No. (Total for CY2003)[a]	Total By Media (5%)	Validation Package Selected for ESS[d]		
						CY2002 (%)	CY2003 (%)	CY2004 (%)
C-404 Semi-annual	TCE, Metals	SW-846 Methods	USEC Lab (Paducah)	28	444[b] (22)[c]	1st Qtr–14 out of 14 (100%) 3rd Qtr–14 out of 14 (100%)	1st Qtr–14 out of 14 (100%) 3rd Qtr–14 out of 14 (100%)	1st Qtr–14 out of 14 (100%) 3rd Qtr–14 out of 14 (100%)
C-746-S&-T	Metals, Rad VOAs, Wet chemistry	SW-846 Methods	USEC Lab (Paducah)	76		1st Qtr–16 out of 16 (100%) 2nd Qtr –16 out of 16 (100%) 3rd Qtr – 16 out of 16 (100%) 4th Qtr – 16 out of 16 (100%)	1st Qtr–19 out of 19 (100%) 2nd Qtr–19 out of 19 (100%) 3rd Qtr–19 out of 19 (100%) 4th Qtr–19 out of 19 (100%)	1st Qtr–19 out of 19 (100%) 2nd Qtr–19 out of 19 (100%) 3rd Qtr–19 out of 19 (100%) 4th Qtr–19 out of 19 (100%)
C-746-U	Metals, Rad VOAs, Wet chemistry	SW-846 Methods	USEC Lab (Paducah)	84		1st Qtr – 16 out of 16 (100%) 2nd Qtr – 16 out of 16 (100%) 3rd Qtr – 16 out of 16 (100%) 4th Qtr – 16 out of 16 (100%)	1st Qtr–21 out of 21 (100%) 2nd Qtr–21 out of 21 (100%) 3rd Qtr–21 out of 21 (100%) 4th Qtr–21 out of 21 (100%)	1st Qtr–21 out of 21 (100%) 2nd Qtr–21 out of 21 (100%) 3rd Qtr–21out of 21 (100%) 4th Qtr–21 out of 21 (100%)
C-746-K	Metals, Rad VOAs, Wet chemistry	SW-846 Methods	USEC Lab (Paducah)	16		1st Qtr – None 2nd Qtr – None 3rd Qtr – None 4th Qtr – 8 out of 8 (100%)	1st Qtr – None 2nd Qtr – None 3rd Qtr –4 out of 4 (100%) 4th Qtr – None	1st Qtr – None 2nd Qtr – None 3rd Qtr –4 out of 4 (100%) 4th Qtr – None
Residential (Monthly)	TCE , ^{99}Tc, and gross alpha/beta	SW-846 Methods	USEC Lab (Paducah)	36		7th Month–3 out of 3(100%) Other Months – None	1st Month–3 out of 3(100%) Other Months – None	1st Month–3 out of 3(100%) Other Months – None
Residential (Semiannually)	TCE , ^{99}Tc, and gross alpha/beta	SW-846 Methods	USEC Lab (Paducah)	36		3srdQtr–18 out of 18 (100%) Other Months – None	1st Event –None 2nd Event –None	1st Event –None 2nd Event –None
Environmental Surveillance (Monthly)	Turbidity, VOAs, Rads	SW-846 Methods	USEC Lab (Paducah)	12		1st Month–1 out of 1(100%) Other Months – None	None	None
Environmental Surveillance (Quarterly)	VOAs and Rads	SW-846 Methods	USEC Lab (Paducah)	0		1st Qtr – None 2nd Qtr – None 3rd Qtr–32 out of 32 (100%) 4th Qtr – None	Quarterly sampling was changed to Semiannual sampling.	Quarterly sampling was changed to Semiannual sampling.
Environmental Surveillance (Seminnually)	VOAs and Rads	SW-846 Methods	USEC Lab (Paducah)	156		1st Event–40 out of 40 (100%) 2ndEvent–None	1st Event–None 2nd Event–None	1st Event–None 2nd Event–None
Total Number of Samples Planned for Validation per CY[g]						276 (56%)	195 (44%)	1995 (44%)

Data Validation Strategy for the Environmental Services Subcontract (ESS)

MEDIA—SURFACE WATER

Sampling Location	Analytical Parameters	Analytical Methods	Analytical Laboratory	Sample No. (Total for CY2003)	Total By Media (5%)	Validation Package Selected for ESS		
						CY2002 (%)	CY2003 (%)	CY2004 (%)
C-746-U	Anions, Metals, TOC, Rads, Wet Chemistry	EPA Methods	USEC Lab (Paducah)	13	59 (3)	1st Qtr – None 2nd Qtr – 3 out of 3 (100%) 3rd Qtr – None 4th Qtr – None	1st Qtr – None 2nd Qtr – None 3rd Qtr – None 4th Qtr – None	1st Qtr – None 2nd Qtr – None 3rd Qtr – None 4th Qtr – None
C-746-S&-T	Anions, Metals, TOC, Rads, Wet Chemistry	EPA Methods	USEC Lab (Paducah)	13		1st Qtr –None 2nd Qtr – 3 out of 3 (100%) 3rd Qtr – None 4th Qtr – None	1st Qtr – None 2nd Qtr – None 3rd Qtr – None 4th Qtr – None	1st Qtr – None 2nd Qtr – None 3rd Qtr – None 4th Qtr – None
Quarterly SW	Metals, Rads, VOAs, Wet Chemistry	EPA Methods	USEC Lab (Paducah)	39		3rd Event – 27 out of 27 (100%) All Other Events – None	1st Qtr – 31 out of 31 (100%) 2nd Qtr – None 3rd Qtr – None 4th Qtr – None	1st Qtr – 31 out of 31 (100%) 2nd Qtr – None 3rd Qtr – None 4th Qtr – None
Surface Water (Semiannually)	Metals, Rads, VOAs, Wet Chemistry	EPA Methods	USEC Lab (Paducah)	0		1st Event – None 2nd Event - None	Semiannaul sampling changed to quarterly sampling.	Semiannaul sampling changed to quarterly sampling.
Total Number of Samples Planned for Validation per CY						33 (14%)	31 (48%)	31 (48%)

MEDIA—SEDIMENT

Sediment (Semiannually)	Metals, PCBs, Rads,	EPA SW-846 Methods	USEC Lab (Paducah)	32	32 (2)	2nd Event – 20 out of 20 (100%)	2nd Event – 16 out of 16 (100%)	2nd Event – 16 out of 16 (100%)
Total Number of Samples Planned for Validation per CY						20 (50%)	16 (50%)	16 (50%)

MEDIA—TISSUE

Terrestrial Biota (Deer)	Metals, PCBs, Rads	EPA SW-846 Methods	USEC Lab (Paducah)	55	None	None	55 out of 55 (100%)
Aquatic Biota (Fish)	Metals, PCBs, Rads	EPA SW-846 Methods	PORTS Lab (Paducah)	9	20 out of 20 (100%)	9 out of 9 (100%)	None
Total Number of Samples Planned for Validation per CY					20 (23%)	9 (14%)	55 (86%)

[a] The total number of samples to be collected for a particular sampling event.

[b] The total number of samples to be collected from all sampling events for a type of media (e.g., groundwater, surface water, sediment, tissue, and leachate).

[c] The total number of samples to be validated to meet a minimum of 5% of the total samples for data validation.

[d] The validation strategy for the next three years has been identified based on the calendar year. Data valuation during CY2002 covered many projects. An effort was made during a Six Sigma Analytical Performance Improvement Process to streamline the data validation strategy for the next few years. Data validation has been performed rigorously over the past 3 years. Significant cut-back have been made on the strategy.

[e] "1st Qtr—14 out of 14 (100%)" is defined as the following:

1st Qtr –the description of the time frame during the year the sampling event takes places (e.g., "1st Qtr" is the First Quarter--January through March--of 1999 or "7th Month" is the seventh month, July, of 1999);
14 out of 14—the number of samples targeted for validation and the number of samples collected,
(100%)—the percentage of data validation to be performed for a particular sampling event.

[f] "None" indicates the samples for this particular event and media was not targeted.

[g] CY = Calendar Year.

[h] The total number of samples targeted for validation per media per calendar year and the percentage of the validated samples to the total number of samples by media. For example, 218 out of 496 groundwater samples will be validated which results in 44 percent of the total number of groundwater samples validated in 2000.

NOTE: For information concerning the validation strategy used in CY 1999, please see a previous version of the ESS QA and DM Plan.

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